PANZERJÄGER VS KV-1

Eastern Front 1941–43

ROBERT FORCZYK

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INTRODUCTION

The KV tanks left the enemy literally shocked. They resisted the fire of every type of cannon with which the German tanks were armed.
General Konstantin Rokossovsky

During the closing stages of World War I, the German Army suffered painful defeats at Cambrai, Soissons and Amiens due to the massed use of tanks by Allied forces. The German military leadership was slow to recognize the threat posed by tanks and responded with ad hoc measures that often proved to be too little, too ineffective and too late. Initially, armor-piercing bullets and the Mauser 13mm T-Gewehr antitank rifle were introduced, which had some effect against the slow and lightly armored tanks of 1916–17. Yet as the Allies introduced heavier tanks in 1918, the deficiencies

A 3.7cm TaK 36 antitank gun in 1918. Experience in World War I shaped the German preference for low-profile, lightweight antitank guns that were easy to maneuver on the battlefield but difficult to detect. (Author)

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in German antitank capabilities became ominously apparent. After a variety of expedient solutions, including issuing small quantities of armor-piercing ammunition to division-level 7.7cm field guns, the German Army finally recognized the urgent need to create a lightweight antitank gun. Rheinmetall was chosen and using available components, its engineers created the 3.7cm TaK antitank gun. Under ideal conditions, the Rheinmetall gun could penetrate 15mm of armor at 500m with its armor-piercing rounds – just enough to defeat the British Mark V tank. Rheinmetall managed to complete about 600 3.7cm TaK antitank guns before the Armistice, but the German Army had to discard these weapons under the terms of the restrictive Treaty of Versailles. According to the treaty, the post-war German Reichswehr could neither possess nor develop antitank guns, which served to ensure the supremacy of the Anglo-French armies.

After their defeat in World War I, German military leaders studied the lessons of that conflict intensively, as well as developments in military technology, and determined to rebuild the Reichswehr with the best weaponry available. In particular, Generaloberst Hans von Seeckt, commander of the Reichswehr, recognized the growing role of tanks in warfare and consequently, the need for effective antitank weapons to counter enemy tanks. He was resolved that German troops would have an answer to the tank in the next war. However, the Reichswehr was forced to develop weapons under the twin constraints of Allied scrutiny and limited budgets, which mandated a covert weapons development effort that could only produce prototypes and token quantities of weapons. When the Reichswehr decided in 1925 to quietly begin developing a new antitank weapon, the *Heereswaffenamt* decided to pick up where it had left off in 1918 and asked Rheinmetall to develop an improved replacement for the 3.7cm TaK. Aside from treaty and funding issues, Rheinmetall's designers adopted a very conservative approach to antitank gun design. At this point, the only countries with any significant numbers of tanks were Britain and France and their designs were still reflective of World War I tank technology. The only heavy tanks in existence were ten French Char 2Cs and the overall trend in armor developments appeared to be in favor of inexpensive light tanks and tankettes, which a 3.7cm weapon could defeat. As Rheinmetall began developing the new 3.7cm antitank gun, the Reichswehr leadership was confident that this weapon would satisfy their antitank requirements for a considerable period.

Yet even as Rheinmetall embarked on the path to providing the German Army with one of the best antitank weapons of the interwar period, it was, oddly, participating in efforts to share this technology with one of Germany's traditional enemies. After the 1922 Treaty of Rapallo, Germany entered into a covert program of arms development with the Soviet Union, enabling German companies such as Krupp and Rheinmetall to experiment with new designs that could not be openly built at home due to the Treaty of Versailles. Rheinmetall was able to develop its new 3.7cm PaK L/45 antitank gun in barely a year, but it could not realistically test this weapon on firing ranges in Germany, which were monitored by the Allies. Instead, an experimental school was set up in 1927 at Kazan in the Soviet Union, where new tank and antitank technologies could be tested in secret. Rheinmetall was particularly eager to join in this covert relationship and contacted the Soviet front company BYUTAST (Bureau for Technical Work and Studies). In late 1929, a Soviet military delegation

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visited Germany and offered contracts to German engineers willing to come work on weapons projects in the Soviet Union. Eduard Grotte, a Rheinmetall employee, volunteered and gathered up a small team of engineers to accompany him to Leningrad in March 1930.

While Rheinmetall was seeking a place to develop and test its new antitank weapon and other hardware, the Red Army was eager to gain access to German engineering experience. Led by Mikhail Tukhachevsky, the Red Army was in transition from the conservative infantry–cavalry force that fought in World War I and the Russian Civil War to a more technologically astute army, fielding tanks, aircraft and mobile artillery. In particular, the Red Army sought a solution to one of the most vexing tactical problems of World War I – how to break an enemy's defense in depth. The Red Army began with a doctrinal approach to the problem. In 1929, Vladimir K. Triandafillov's book, *The Character of Operations of Modern Armies*, set the framework for the theory of "Deep Battle" (*glubokiy boy*) and advocated the creation of large armored units to break through enemy defenses. By 1931, Deep Battle was widely accepted as a viable doctrine for the Red Army. Furthermore, Soviet military theorists believed in multi-echelon offensives, conducted in waves; and early Russian tank advocates recognized the need for a variety of types, ranging from light tanks for infantry support, medium tanks for exploitation and heavy tanks to conduct breakthrough attacks. Once the

The battlefield mobility of the 3.7cm PaK was a primary selling point for the German Army, which wanted an antitank weapon that could be used to support river crossings and fighting in broken terrain. The 3.7cm PaK was designed with German maneuver doctrine – not likely opposition – in mind. (Ian Barter)

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Soviet Ministry of Defense established a requirement for Soviet industry to design a heavy tank for mass production, Tukhachevsky, Triandafillov and others had faith that the Red Army would be able to crush its opponents on the battlefield.

Thus, the groundwork for the eventual duel between German antitank units[1] and Soviet heavy tanks was laid on the odd dynamic that the Germans needed Soviet ranges to test their newest antitank guns, while the Soviets needed German engineering expertise to build their heavy tanks. Both sides were using each other in the hope of improving their own weapon systems. Up to 1933, both sides were well aware of each other's technological capabilities; Rheinmetall even sold 3.7cm PaK L/45 antitank guns to the Soviets, while German engineers participated in designing the first generation of Soviet heavy tanks. However, once Adolf Hitler came to power and pushed Germany on a path toward eventual war with the Soviet Union, the period of technological cooperation ceased and both the Wehrmacht and Red Army began preparations for an eventual showdown. German arrogance assumed that the Wehrmacht was technologically well ahead of the Red Army and that Soviet engineers were incapable of designing effective tanks without foreign assistance. Yet when war came in June 1941, the German Army received a severe shock in the first two days of the campaign – the Red Army had actually succeeded in designing and mass-producing a heavy tank with armor that German antitank guns could not penetrate. The conditions for a classic military–technological duel were set on the battlefields of the Soviet Union, as the Wehrmacht desperately tried to improve its antitank capabilities to counter the Soviet KV-series heavy tanks, while the Red Army was equally desperate to use its near-invulnerable KV tanks to spearhead counteroffensives to drive out the hated invaders. It was a duel fought at the tactical level throughout 1941–43, but it had profound operational-level consequences.

1 Initially called Panzer*Abwehr* then renamed Panzerjäger in April 1940.

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CHRONOLOGY

1925
February The Reichswehr develops a requirement for a new 3.7cm antitank gun.

1927
June *Heereswaffenamt* prioritizes development of a 3.7cm PaK.

1928
January Rheinmetall completes first 3.7cm PaK L/45 prototype.

1929
May Rheinmetall begins low-rate production of 3.7cm PaK L/45 antitank gun.
July Soviet Ministry of Defense authorizes development of heavy tanks.

1930
August 28 Rheinmetall signs secret deal to provide antitank technology to USSR.
December Soviets begin work on T-30 heavy tank project.

1931
November OKMO begins building a T-30 prototype.

1932
February T-30 abandoned; switch to T-35 development.
September OKMO tests first T-35 heavy tank prototype.

1933
August Limited production of T-35 begins.

1934
September Rheinmetall begins conversion of 3.7cm PaK L/45 to upgraded standard.

The first Soviet heavy tank, the multi-turreted T-35, was introduced in 1933. However, the 45-ton T-35 was not a successful design and its thin armor could be penetrated by the German 3.7cm PaK gun at 400m. (Steven Zaloga)

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An artillery assembly hall at Rheinmetall-Borsig's Düsseldorf plant in 1939. Rheinmetall was responsible for designing and manufacturing the bulk of the antitank weapons on the Eastern Front in 1941–43. Like most German industry, Rheinmetall did not gear up for the demands of total war until after the Stalingrad debacle. (Author)

1935

Rheinmetall begins developing a 5cm PaK.

1937

November ABTU issues requirement for a new heavy tank resistant to 76mm-gun fire and having a diesel engine.

1938

May Rheinmetall wins contract to deliver 5cm PaK.
OKMO and Kotin teams present SMK and T-100 designs to Defense Council. Stalin approves construction of prototypes.

1939

February Kotin decides to build single-turret heavy tank (KV).
May T-100 prototype completed.
August SMK prototype completed; Stalin approves KV as well.
First 5cm PaK 38 prototypes built.
September KV prototype completed.
Trials begin on T-100, SMK and KV-1.
Krupp and Rheinmetall begin development of a 75mm PaK gun.
December SMK, T-100 and KV prototypes see combat in Russo-Finnish War.
December 19 KV-1 approved for production; other two abandoned.

1940

February Prototypes of KV-2 built.
March Panzerjäger I with Czech 4.7cm gun on PzKpfw I chassis enters service.
April KV-1 enters limited production.
May 3.7cm PzGr 40 tungsten-core round enters service.
August 5cm PaK 38 antitank gun enters low-rate production.

1941

May 5cm PzGr 40 round for PaK 38 introduced.
June 27 Special Commission from OKH sent to *Heeresgruppe Nord* to investigate KV tanks.
November 4.2cm PaK 41 prototype completed.

1942

February *Stielgranate* 41 introduced for 3.7cm PaK.
7.5cm PaK 40 antitank gun enters service.
7.5cm PaK 97/38 introduced as stopgap solution.
April Captured Soviet 76.2mm guns converted into 7.62cm PaK 36(r).
First *Marder* II with 7.62cm PaK 36(r) built.
June Hitler bans further use of tungsten in antitank ammunition.
August KV-1S is introduced.

1943

February *Hornisse* heavy self-propelled Panzerjäger with 8.8cm gun begins production.
November 8.8cm PaK 43 enters service.

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DESIGN AND DEVELOPMENT

The last capitalist we hang shall be the one who sold us the rope.
Karl Marx

THE SOVIETS

In the late 1920s, Mikhail Tukhachevsky and other Red Army theorists envisioned that large numbers of medium and heavy tanks would be necessary in order to prevail in the next war, which was expected to be fought against a coalition of Western capitalist states. At the time, the only modern heavy tank in existence was the British multi-turreted, 34-ton[2] Vickers A1E1 Independent, which impressed Tukhachevsky who regarded it as the template for a Soviet heavy tank. In July 1929, the State Defense Committee authorized construction of several new types of tanks, including a heavy tank. In order to meet this objective, an experimental tank design bureau known as OKMO (*Opytniy Konstruktorsko-Mekhanicheskiy Otdel*) was set up in Leningrad's Voroshilov Factory (Zavod 174) in 1930 under the leadership of Nikolay V. Barykov. Leningrad's Kirov Factory (Zavod 100) also established a tank design bureau. However, no Soviet engineers had any practical experience in designing large armored vehicles,

2 All tonnages given in the book are metric tons (please see the conversion chart on page 2).

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so foreign expertise was necessary to jump-start the Soviet heavy tank project. When Eduard Grotte's small team of German engineers arrived in Leningrad in March 1930, he was given the lead in developing the heavy tank, while Barykov looked over his shoulder. Tukhachevsky envisioned a small number of invulnerable, heavy tanks to lead breakthrough attacks, with technical capabilities akin to those of the Vickers A1E1 Independent.

Presiding over Soviet tank development was the State Defense Committee, headed by People's Commissar Kliment Voroshilov, one of Stalin's closest and most servile cronies. Stalin himself tended to get involved in critical weapons decisions, although he lacked a head for technical issues. Requirements for tanks were written by the Red Army's Office of Mechanization and Motorization (UMM), which was created in 1929 to develop tanks, as well as train and organize all mechanized forces. From 1929 to 1936, the UMM was headed by Innocent A. Khalepsky, followed by Dmitry G. Pavlov from 1937 to 1940, both of whom influenced Soviet heavy tank development.[3] Khalepsky drafted a requirement for a 60-ton tank mounting two 76.2mm guns, one 37mm gun and six machine guns. Early Soviet armor officers, like those in other countries, believed that a heavy tank needed both high-velocity guns for antitank combat and a low-velocity gun for use against infantry, as well as machine guns to cover every potential arc of fire. Hence, multiple turrets were regarded as essential for a breakthrough tank.

As it turned out, the Soviets had not checked Grotte's qualifications very carefully, for he too had no expertise in tank development. Within just six weeks of arriving in Leningrad, Grotte's team presented a design to the Military Council and after giving it negligible consideration, Voroshilov approved the design for production. This propensity for making snap decisions on production before prototypes had even been built or properly tested would continue to plague Soviet heavy tank development for the next ten years. Voroshilov also failed to notice that Grotte had ignored the requirements specified by UMM and designed a 20-ton tank mounting a single 76.2mm gun and a 37mm gun, with 30mm of armor protection. Since the Soviets had no tank engines or transmissions in production, Grotte's team was also tasked with developing a completely new engine and transmission for their tank, which further indicates the lack of serious consideration given by the Military Council. Not surprisingly, Grotte's team failed to complete a working transmission or engine, but instead cobbled together an existing aircraft engine with a tractor transmission. Somehow, Grotte managed to complete a soft-metal prototype by July 1931, but early trials indicated that the vehicle could barely move. OKMO's engineers did learn how to construct welded tank chassis from Grotte's team, but otherwise there was little technical benefit from the experience. One bad habit OKMO engineers acquired from Grotte was using off-the-shelf components such as transmissions, rather than making an effort to design purpose-built components. Aghast at wasting over 15 million rubles and a year of development on Grotte's scrap-heap tank, the Military Council canceled his project and handed the reins back to OKMO. Grotte remained at OKMO for another year, cranking out a worthless design for a 100-ton tank and

3 The UMM was renamed the Automotive and Armored Vehicle Directorate (ABTU) in 1934, then GABTU in 1940.

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A 1937 propaganda poster depicting Stalin and Voroshilov reviewing the Red Army's May Day parade in Moscow, with the T-35 prominent in the foreground. Stalin believed that heavy tanks were a visible symbol of the military power of the Soviet Union and useful for deterring a German attack. Thanks to these demonstrations, the Germans were aware of the T-35, but not impressed. (Author)

wasting resources until he was shown the door and returned to Germany. In order to satisfy Voroshilov – who was equally eager not to disappoint Stalin – Barykov scrambled to develop a prototype T-30 heavy tank to meet the original UMM requirement, but only succeeded in constructing a wooden mock-up by February 1932. The hastily designed T-30 was expected to weigh about 55 tons, mount one 76.2mm gun and one 37mm gun, and have 40–60mm of armor. However, the UMM stuck to its obsession with multiple turrets and when Barykov could not reconfigure the T-30 to meet this requirement, the project was canceled.

Even before the demise of the T-30, the OKMO team had begun investigating other alternatives. Semyon A. Ginsburg, an engineer from the UMM, visited the United Kingdom on a purchasing mission and paid Vickers £20,000 to review the plans for the 16-ton A-6 medium tank under development. Soviet espionage was also successful in gathering other tank design information in England. After this, Ginsburg went to the Tank School at Kazan, where he reviewed all the technical documentation available on Rheinmetall's *Grosstraktor* II tank prototype. Armed with this knowledge, Ginsburg joined Barykov's SKB-1 design team at the Voroshilov plant and was able to sketch out some new designs, employing everything learned from recent British and German developments. However, the UMM decided to split the development effort into two distinct multi-turreted designs, one as a 45-ton heavy tank (T-35) and the other as a 28-ton medium tank (T-28). Barykov assigned Nikolay V. Tseyts' SKB-2 to design the T-35, while Ginsburg designed the T-28. Tsyets was a rather uninspired tank designer, but his team succeeded in constructing a prototype of the T-35 heavy tank by September 1932. Again with virtually no thought, Voroshilov pressured the UMM into approving the T-35 heavy tank and ordered production to begin as soon as possible. To Voroshilov's eye, the T-35 was a "land battleship" that would visibly demonstrate the power of the Red Army. In reality, the 45-ton T-35 was an awkward design with a total of five turrets mounting one 76.2mm gun, two 45mm guns (derived from the 3.7cm Rheinmetall gun) and six machine guns, but no more than 30mm of armor. The UMM recognized that the T-35 was an interim solution and directed that production of the T-35 should be shifted to the Kharkov KhPZ tank plant, thereby freeing up OKMO to prepare for a follow-on heavy tank. KhPZ was fully occupied with producing the BT-series fast tanks and needed nearly two years to begin limited production of the T-35. Early trials with the T-35 revealed that it had extremely poor mobility, being barely able to climb gentle slopes, and one commander remarked that, "It couldn't even traverse a large puddle." Internally, the 10-man crew could not even move about within the vehicle; and trials revealed that the tank

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commander could not effectively control the fire of five turrets. Once the deficiencies of the T-35 became apparent, the UMM directed KhPZ to cap production at 61 tanks, while using the existing tanks for experimentation and propaganda purposes. Although the T-35 design did not result in a useful heavy tank, OKMO had learned something about what did not work in a breakthrough tank.

As OKMO engineers struggled to develop a practical heavy tank design, they were also bedeviled by the difficulties Soviet industry faced in providing suitable engines and armament. Early Soviet tanks had to rely upon German-designed aircraft engines, built under license at Rybinsk. Indigenously built tank engines were not available until early 1939; then suddenly there were two alternatives: the GAM-34BT gasoline engine or the V-2 diesel engine. Similarly, prior to 1939 the only 76.2mm weapons available were left over from the Tsarist era. Vasiliy Grabin's TsAKB artillery design bureau at Gorky did not begin producing purpose-built tank guns until just prior to the outbreak of World War II, commencing with the L-11 and followed by the F-32 and F-34. Even more problematic, artillery development fell under the control of Marshal Grigori I. Kulik, who was opposed to diverting resources for tank gun development and frequently hindered the Red Army's creation of a heavy tank force. Thus, OKMO's ability to deliver a useful heavy tank was constrained by having to wait upon developments in the automotive and armaments industries.

After the T-35 fiasco – which wasted more than two years' worth of development effort – OKMO settled back into trying to develop an effective heavy tank. While the SKB-2 design team at the Kirov plant continued to refine the T-28, Ginsburg and Barykov led the SKB-1 design team in developing new tanks. In 1934, the talented engineer Mikhail Koshkin joined the design team, although Tseyts was still the principal designer. Instead of the clumsy, heavy tanks produced to date, Koshkin envisioned an entirely new 30-ton tank that was relatively fast and designed to resist penetration from a 3.7cm antitank gun, such as the PaK 36. Barykov approved Koshkin's design, which was designated as the T-46-5 and later the T-111. The T-111 had 60mm of sloped armor protection and a 45mm gun in a cast turret; overall it was a far more sophisticated design that anything Tsyets had developed and Koshkin was awarded the Order of the Red Star for his design. However, Koshkin had shown up the OKMO team and in December 1936 he was transferred to head the design bureau at KhPZ, where he would soon design the revolutionary T-34 tank. OKMO eventually built a prototype T-111 after Koshkin left, but it never entered production.

In May 1937, Stalin began his purge of the Red Army, beginning with the arrest, trial and execution of Tukhachevsky and other top generals. The head designer for SKB-2 was also executed, leaving the effort of designing a new heavy tank leaderless. Into this void, Zhosef Kotin arrived from the UMM not only to head the SKB-2 design team, but to coordinate the development efforts of all three tank factories in Leningrad. Kotin was a trained engineer, but he was also very political and willing to use party connections. Yet contrary to oft-repeated accounts, he was not married to Voroshilov's daughter.[4] Six months later, the new director of the Directorate of Armored Forces (GABTU), Dmitry Pavlov, finally updated the original 1929 requirement for a heavy tank with a new emphasis upon armored protection and the

4 He was married to an engineer from the UMM named Nataliya Poklonova.

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Nikolay L. Dukhov (1904–64) was the primary designer of the KV tank. He was a talented engineer in the SKB-2 design bureau and later played a major role in establishing KV production at Chelyabinsk. After the war, Dukhov was recruited into the Soviet nuclear weapons program and helped direct construction of their first atomic bomb in 1949. Although Dukhov played an important role in designing both the KV-1 and the first generation of Soviet nuclear weapons, he is virtually unknown in the West. (Author)

use of a diesel engine. Based upon his experience in Spain commanding Soviet tanks, Pavlov wanted a "shell-proof" tank that was invulnerable to 3.7cm antitank fire and able to resist 7.5cm weapons at ranges of 1,200m. Pavlov was smart enough to see the need not only to counter the current German 3.7cm PaK, but to anticipate Rheinmetall developing a 7.5cm weapon. Kotin was eager to prove his ability to manage an important project, so he gave SKB-1 and SKB-2 just six months to develop designs to meet Pavlov's requirement. Apparently Kotin thought that competitive rivalry between the two teams would improve the final product but in fact, his decision wasted much of the available engineering talent on redundant designs. In a flurry of activity, both teams tried to pull together lessons learned from the T-35 and the T-111 in order to produce a new design, with the emphasis upon haste, not innovation. Since the GABTU requirement emphasized protection, both teams focused on designing a tank with at least 60mm of frontal armor; but neither was aware that KhPZ had nearly perfected a diesel tank engine, so they continued to rely upon a gasoline engine. Since there was no time to develop a new transmission, Kotin's engineers took a page from Eduard Grotte's crash course on designing tanks and simply substituted the transmission from an American Holt 10-ton tractor. Since Kotin was aware that his predecessor had been executed, he figured that completing projects on schedule was more important than the fine details, such as using transmissions designed to move 10-ton tractors to move a 55-ton tank.

In May 1938, both teams presented their designs to Stalin and Voroshilov, who approved them for further development. Over the next six months, the Barykov/Ginsburg SKB-1 team developed their design as the T-100 tank, while Tseyts' SKB-2 team worked on their design. Kotin was aware that Koshkin was designing a new medium tank at KhPZ that could compete with his heavy tank designs, so in a blatantly political move, Kotin decided to designate Tseyts' design as the "SMK" after Sergei Kirov. Both the T-100 and SMK would use the newly developed 76.2mm L-10 gun and the GAM-34BT gasoline engine, as well as torsion-bar suspension.

On December 9, 1938, Kotin went to Moscow to present wooden models of the two heavy tank designs to the State Defense Committee, with Stalin, Voroshilov and Pavlov present. When asked if these 55–58-ton tanks would have better mobility than the 45-ton T-35, Kotin demurred. In response, Stalin broke off one of the 37mm gun turrets from the SMK model and asked how much weight that would save, which brought Kotin's response of 2.5 tons. Stalin then told Kotin to use the weight saved on armor instead and to consider reducing the design to just one turret, if a single gun could fulfill the antitank and anti-infantry roles. He then approved further development for both designs but specified that a working prototype for each had to be ready by August 1939. Clearly, Stalin suspected that war was coming in Europe and wanted the design bureaus to stop fumbling with interim designs and settle on a practical heavy tank with decent protection and mobility.

Kotin returned to Leningrad and ordered the SKB-1 and SKB-2 design teams to go flat out to produce prototypes by the following summer. However, to hedge his bets, he had SKB-2 assign Nikolay L. Dukhov and some graduate students from the UMM to develop a single-turret version of the SMK as well. It was not until mid-1939 that Kotin became aware that the V-2 diesel engine was ready for production and he quickly sent Dukhov to Kharkov to assess it. Dukhov reported that the V-2 was a

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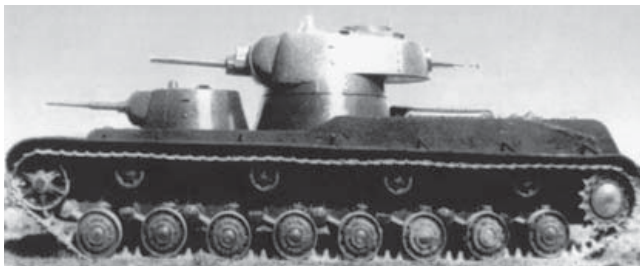
major breakthrough in tank motive power, but it was too late to integrate it into the T-100 or SMK prototypes if they were to meet Stalin's deadline. Instead, Kotin ordered both prototypes completed with the GAM-34BT gasoline engine, but told Dukhov to fit the V-2 into his single-turret variant, which he had decided to name the KV in honor of Voroshilov. Both the SMK and T-100 prototypes were ready ahead of schedule, but the KV was not ready until September 1939. All three prototypes were sent to Kubinka in late September for trials, where they were viewed by Voroshilov and Pavlov. Koshkin was there as well, with his new medium tank, the T-32. Kotin was surprised by the sophistication of the T-32, which demonstrated far superior engineering quality than any of his tanks. Voroshilov regarded all three heavy tank designs favorably, but decided to defer an immediate decision on production.



The SMK tank was the immediate predecessor of the KV-1. OKMO's conception of the breakthrough tank required a high-velocity 45mm gun in the forward turret, plus a low-velocity 76.2mm gun in the main turret, enabling the SMK to deal with multiple threats. (Author)

Meanwhile, on November 30, 1939, Stalin decided to invade Finland, which Kotin saw as an opportunity to combat-test the three prototypes. OKMO's entire stable of heavy tank prototypes, consisting of one SMK, two T-100s and two KVs, were sent to the front in Karelia. The five heavy tank prototypes were assigned to the 20th Heavy Tank Brigade, whose deputy commander was Marshal Kulik's son. On December 19, the tank brigade supported a deliberate attack upon one of the strongest parts of the Mannerheim Line near Summa. Finnish Bofors 37mm antitank guns proved utterly unable to stop the Soviet heavy tanks. Although the heavy tanks succeeded in their breakthrough role by penetrating the Finnish obstacle belt, the SMK was immobilized by a mine and one of the T-100s had an engine failure. Due to poor inter-arms coordination, the Soviet attack was repulsed and the SMK prototype was abandoned. Yet the T-100 demonstrated the value of its armor, which was hit by 14 37mm antitank rounds without a single penetration. The KV prototypes also proved invulnerable to Finnish antitank guns, but the 76.2mm L-11 gun on all three prototypes proved ineffective against enemy bunkers.

After the action at Summa, the SMK was regarded as a failure and the project abandoned, but the two T-100s were repaired and saw further combat in February–March 1940, as did three other KV prototypes. After the first reports from Summa, the State Defense Committee decided to approve the KV for production immediately without further testing, even though it had been driven less than 500km (312mi). However, the inadequacy of a 76.2mm gun against bunkers was apparent and General Kirill Meretskov, commander of the 7th Army in Karelia, requested that a larger-caliber weapon was needed to deal with fortified zones such as the Mannerheim Line. Consequently, GABTU recommended production of the 76.2mm-armed model as the KV-1, and a KV-2 assault tank armed with a 152mm howitzer to be developed from the T-100. Working day and

The first KV heavy tank prototype was completed in September 1939 and attempted to squeeze the 45mm and 76.2mm guns from the SMK into a single turret. Production models dispensed with the 45mm gun. (Author)

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KV-1 MODEL 1940 "EKRANAMI" (WITH SCREENS)

Combat weight: 47.5 tons
Crew: five (commander, gunner, driver–mechanic, auxiliary driver, radio-operator)

Dimensions
Length with gun: 6.9m
Width: 3.32m
Height: 2.7m

Armor
Hull front: 75+35mm at 60 degrees
Hull sides: 75+35mm at 90 degrees
Hull rear: 60–75mm at 40 degrees
Hull roof: 35mm at 0 degrees
Turret front/mantlet: 75/90mm at 70 degrees/round
Turret sides: 75+35mm at 75 degrees
Turret rear: 75mm at 75 degrees
Turret roof: 35mm at 0 degrees

Armament
Main gun: 1 x 76.2mm F-33 L/42
Secondary: 3 x 7.62mm DT (coaxial, rear, hull)
Main gun rate of fire: 4–8 rds/min
Gunsight: PT4-13 with 26-degree field of view

Ammunition stowage
Main gun: 114 rounds (28 rounds BR-350A APHE, 86 rounds OF-350 HE-FRAG)
Secondary: 2,150 rounds

Communications
71-TK-3 radio; TPU-4-*bis* intercom

Motive power
Engine: V-2 12-cylinder diesel
Power: 600hp
Transmission: 5 gears forward, 1 reverse
Fuel capacity: 600l diesel
Power-to-weight ratio: 12.63hp/ton

Performance
Ground pressure: 0.84kg/cm²
Maximum road speed: 28km/h (17mph)
Maximum cross-country speed: 16km/h (10mph)
Operational range: 250km (156mi) (road), 180km (112mi) (cross-country)
Fuel consumption: 2.4l/km (road)

Cost: 635,000 Rubles ($120,000 or 300,000 RM)

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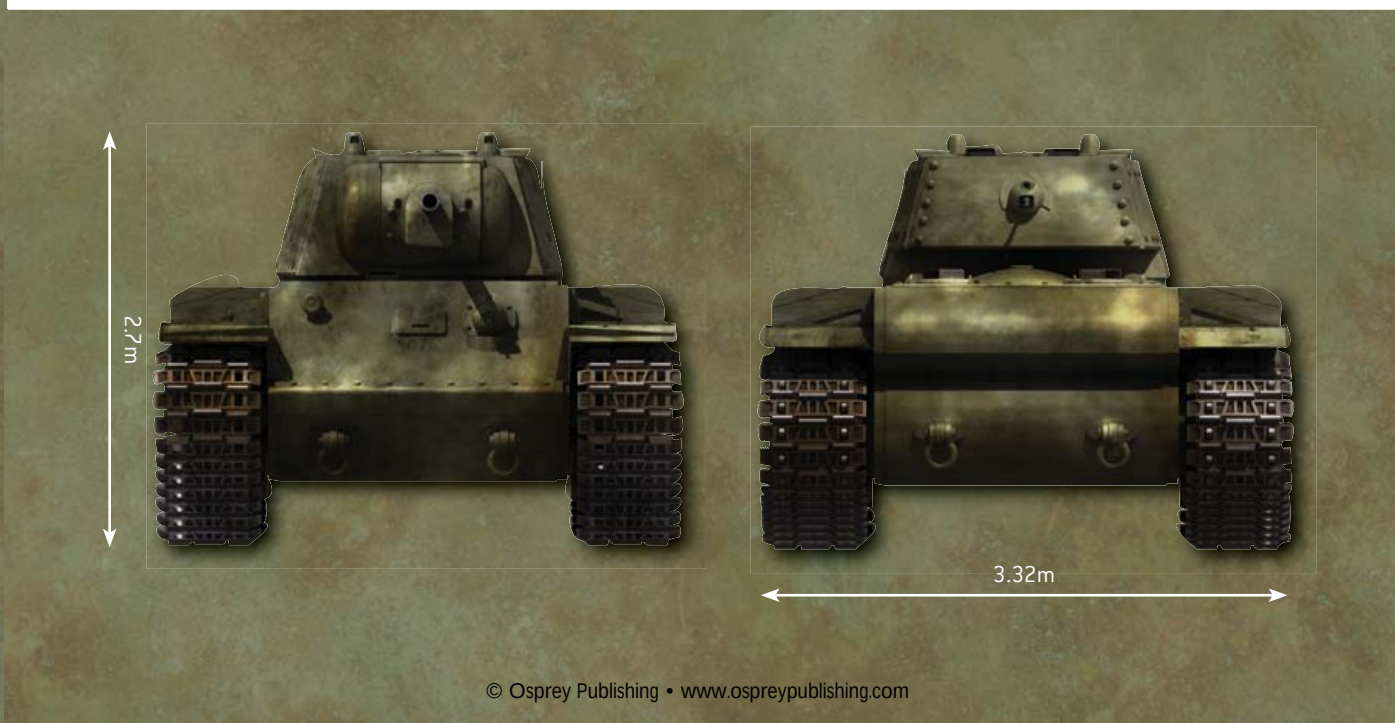
night, engineers from the Kirov plant designed the KV-2 in just two weeks and then installed an ML-10 howitzer on a KV hull, creating the first KV-2. Once again, Voroshilov and the State Defense Committee approved another heavy tank for production without adequate testing. Criticism from Soviet tankers in Finland about the KV's mobility problems was ignored, even though the commander of the 20th Heavy Tank Brigade reported that in one action, "the KV lay in the snow and almost could not move."

Regular production of the KV-1 and KV-2 began at the Kirov plant in June 1940, although the State Defense Committee instructed the Chelyabinsk Tractor Plant (CTZ) also to begin tooling up for production of the KV. Between June 1940 and June 1941, monthly production rose to 50–60 KVs, split roughly between KV-1 and KV-2. The very first KVs built were assigned to the 20th Heavy Tank Brigade in Leningrad, which made sense since the tanks were thus close enough to the Kirov plant to remedy any defects quickly. Pavlov recommended that all new KV battalions should be formed in Leningrad for ease of training and repair, before dispatching them to join the mechanized corps in the various military districts. However, Stalin was personally interested in the KV and only two months after production began in Leningrad, he ordered all available KVs sent to the 4th Mechanized Corps in the Kiev Military District. Stalin's desire to get KVs to frontline units as fast as possible undermined both the refinement of the KV design at the Kirov plant and the amount of training Soviet tankers received on the new weapon.

The KV-1 was intended to fulfill the role of a breakthrough tank, with an ability to punch through an enemy fortified area defended by antitank guns and then advance at least 10–15km into the enemy depth to overrun their artillery. The GABTU believed in specialization, with the KV-1 creating the breakthroughs that the more mobile T-34 and light tanks would exploit. Kotin's KV-1 appeared to be the breakthrough tank envisioned by Tukhachevsky, and Stalin expected it to provide the Red Army with a decisive advantage.



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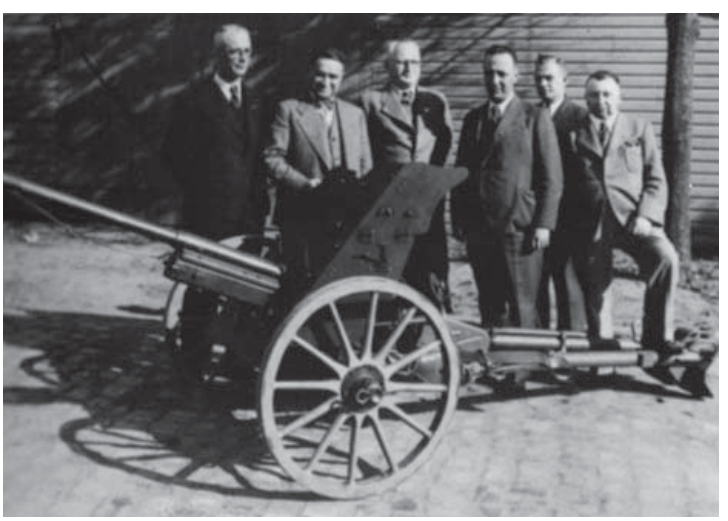
THE GERMANS

In February 1925, the Reichswehr quietly began to issue requirements for new weapons, beginning with the need for a new antitank weapon and a light infantry gun. However, the two primary German artillery manufacturers – Rheinmetall in Düsseldorf and Krupp in Essen – were at that time under virtual lockdown due to the French occupation of the Ruhr. The Inter-Allied Control Commission had forced Rheinmetall to lay off 9,000 workers and sell most of its machine tools, leaving it with little remaining capacity for weapons production. It was not until August 1925 that French troops evacuated the Ruhr and both companies could resume their traditional roles as suppliers of German armaments. Rheinmetall was given the nod by the Heereswaffenamt for both new weapons, although an actual contract was not forthcoming until June 1927.

Based upon their experience from World War I and the limited financial resources of the Reichswehr, the German preference was for inexpensive, light, mobile antitank guns that could be mass-produced and distributed in depth. Rheinmetall was selected because its engineers had built the successful 3.7cm TaK 36 and because Krupp was more interested in developing heavy artillery. Dr Carl Waninger was put in charge of a team of 25 engineers who worked in secret at an abandoned firing range on Lüneberg Heath. In just over six months, Waninger's team built the first 3.7cm *TankAbwehrkanone* (standardized as the 3.7cm PaK L/45) prototype. In ballistic terms, this 3.7cm gun was a very advanced design for 1928 and no other country had a similar antitank gun at this point. The Heereswaffenamt decided not to risk test firing the prototype in Germany due to the vigilance of Allied inspectors and instead covertly shipped a few 3.7cm guns to the school at Kazan, where they demonstrated the gun's ability to penetrate 29mm of armor plate at a distance of 500m. Satisfied with Rheinmetall's prototype, the Heereswaffenamt approved low-rate production of 14 weapons per year in May 1929. The modest objective was to eventually equip each Reichswehr division with 36 PaK guns. Yet the Reichswehr did not want openly to violate the Treaty of Versailles, so the PaK guns were put in storage and troops continued to train with wooden antitank guns.



The first 3.7cm PaK L/45 was covertly designed by Dr Carl Waninger's small Rheinmetall design team in the late 1920s. With its wooden-spoked wheels, this weapon was not designed to be towed at high speed by a vehicle. Despite the restrictions of the Treaty of Versailles, Germany succeeded in deploying the first high-velocity antitank gun in the world. (Author)

However, this low-rate production contract was not profitable for Rheinmetall, and the constraints imposed upon German arms firms made it unlikely that this would change as long as the treaty was enforced. Eager to develop profitable arms sales, particularly in Depression-era Germany, Rheinmetall turned to the Soviets. Rheinmetall's agents contacted the Soviet front company BYUTAST, which had been established to procure arms technology from the West. On August 28, 1930, Rheinmetall signed a secret contract worth $1.125 million to provide

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antitank technology to the Soviet Union, including a dozen 3.7cm PaK L/45 guns and designs for five other artillery weapons. Using their PaK L/45 as a starting point, Rheinmetall's engineers designed the 37mm M1930 (1-K), which was built at Plant No 8 in Kalinin for the Red Army. As it turned out, Soviet factories had difficulty producing a weapon like the 1-K and barely 400 were built in 1931–33 before the Soviets decided to design their own weapon and increase the size to 45mm. In the process, Soviet engineers learned a good deal about German antitank developments.

Thanks to the capital infusion from the Soviets, Rheinmetall was able to continue development of the 3.7cm PaK gun, as well as beginning work on a number of new weapons, including 2cm Flak guns and 10.5cm and 15cm medium howitzers. Between 1928 and 1933, Rheinmetall made little effort to improve the 3.7cm PaK L/45, but once Hitler became chancellor in 1933, it was clear that the restrictions of the Treaty of Versailles would soon be renounced. Hitler favored the development of motorization in the German Army and the *Truppenamt* (Troop Office) led by Generalleutnant Ludwig Beck, moved to align new weapons development with this objective. Since the 3.7cm PaK L/45, with its wooden spoked wheels, was designed to be pulled by horses as German artillery traditionally had been, it was clear that the PaK was inconsistent with the push toward motorization. In September 1934, Beck directed Rheinmetall to modify the 3.7cm PaK to be towed by motor vehicles and subsequently, pneumatic tires, which replaced the wooden wheels and springs, were added on the carriage. The modified PaK was available early in 1935 and standardized as the 3.7cm PaK, with the Krupp *Protze* (Kfz 69, limber 69) designated as its preferred towing vehicle. When Hitler renounced the military restrictions of the Treaty of Versailles in March 1935, Rheinmetall was directed to begin mass production of the 3.7cm PaK and Wehrmacht troops began to train on it. Work was also begun on improved antitank rounds for the 3.7cm PaK, including the use of tungsten-carbide penetrators.

Three other important antitank developments occurred within Germany in the 1930s. First, an engineer in Hamburg, Hermann Gerlich, experimented with tapered-bore barrels to increase muzzle velocities on rifles. Although Gerlich died in 1935, his concepts created interest in applying this type of technology to antitank weapons and the Mauser company began development of a tapered-bore antitank weapon. Since the Wehrmacht had no official requirement for this type of weapon, Mauser conducted the development on its own initiative. It took nearly five years to create a working prototype. The first prototype, designated the 2.8cm sPzB 41, was not ready until early 1940 but tests indicated that it had better penetration than the 3.7cm PaK and weighed significantly less, which validated the tapered-bore concept. The Heereswaffenamt now took an interest in tapered-bore weapons and directed both Krupp and Rheinmetall to investigate larger weapons using this principle. However, a number of problems

The 3.7cm PaK was not openly used in German Army training until after Hitler came to power in 1933. In order to keep up with the Wehrmacht's new doctrines on mobile warfare, in 1935 the 3.7cm PaK was upgraded with pneumatic tires and better suspension. (Ian Barter)

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GERMAN ANTITANK GUNS

3.7cm PaK 36 L/46.5

Manufacturer: Rheinmetall-Borsig
Crew: 6
Prime mover: Kfz 69 Krupp-Protze
Length: 3.4m
Width: 1.65m
Height: 1.17m
Weight: 440kg
Elevation: +25 degrees/–8 degrees
Traverse: 59 degrees
Rate of fire: 15–18 rds/min
Barrel life: 4,000–5,000 rounds

Gunsight: ZF 1 x 11 (3 x magnification, 11-degree field of view)
Maximum engagement range: 600m
Ammunition: PzGr 39 AP, PzGr 40 APCR, *Stielgranate* 41
Cost: 5,730 RM ($2,292 or 12,147 Rubles)

5cm PaK 38 L/60

Manufacturer: Rheinmetall-Borsig
Crew: 5
Prime mover: SdKfz 7, 8 or 11
Length: 4.75m
Width: 1.83m
Height: 1.1m
Weight: 986kg
Elevation: +27 degrees/–5 degrees
Traverse: 65 degrees
Rate of fire: 12–14 rds/min
Barrel life: 4,000–5,000 rounds

Gunsight: ZF 3 x 8 (3 x magnification, 8-degree field of view)
Maximum engagement range: 1,500m
Ammunition: PzGr 38 AP, PzGr 40 APCR
Cost: 8,000 RM ($3,200 or 16,690 Rubles)

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A German 3.7mm PaK crew in action in Russia, June 1941. This photo from *SIGNAL* magazine depicts the Panzerjäger without camouflage and in the middle of the road, which would lead to their quick annihilation if up against KV heavy tanks. (Author)

with the tapered-bore concept were evident from the beginning, including greatly reduced barrel life, a rapid drop-off in performance after 500m, and reliance on scarce tungsten penetrators.

The Heereswaffenamt had also been interested in the efficacy of *Hohlraumgranaten* (hollow-charge or HEAT shells), but no practical design emerged prior to 1935. Hollow-charge ammunition had the potential to penetrate thick armor plate with a jet of gas but without the requirement for high muzzle velocities or scarce metals.

7.5cm PaK 40 L/48

Manufacturer: Rheinmetall-Borsig
Crew: 8
Prime mover: SdKfz 7, 8 or 11
Length: 3.45m
Width: 2m
Height: 1.25m
Weight: 1,500kg (1,425kg deployed)
Elevation: +22 degrees/–5 degrees
Traverse: 65 degrees
Rate of fire: 11–14 rds/min
Barrel life: 6,000 rounds
Gunsight: ZF 3 x 8 (3 x magnification, 8-degree field of view)
Maximum engagement range: 1,800m
Ammunition: PzGr 39 AP, PzGr 40 APCR, Gr 38 HI/B HEAT
Cost: 12,000 RM ($4,800 or 25,440 Rubles)

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Furthermore, hollow-charge shells could be fired from almost any artillery piece, not just dedicated PaK guns. A Swiss inventor in Zurich, Henry Mohaupt, was the first to perfect a hollow-charge antitank warhead in 1935 and was able to sell it to the French Army. Around the same time, an Austrian chemical engineer, Franz R. Thomanek, made similar progress in hollow-charge design, possibly with information gleaned from Mohaupt's research. After the Austrian *Anschluss*, Thomanek was hired by the Luftwaffe and worked at a research institute in Braunschweig where he perfected his own hollow-charge warhead. Early tests were promising, indicating that the warheads could penetrate 70–80mm of armor plate, so in late 1939 the Heereswaffenamt authorized Thomanek to create a company for the manufacture of hollow-charge warheads. However, fusing was a problem with early hollow-charge ammunition and the shells worked best in low-velocity howitzers, not high-velocity PaK guns. Consequently, the first hollow-charge antitank ammunition issued in late 1941 was 7.5cm rounds for the PzKpfw IV tank and StuG III assault gun; the Panzerjäger would not receive hollow-charge rounds until early 1942.

The third major antitank development in Germany was the growing interest in mounting PaK guns on vehicles. In 1930, Rheinmetall mounted a 3.7cm PaK L/45 on an experimental tracked chassis at Kazan, but no orders were placed. Once the first Panzer divisions were formed in 1935, there was a realization that the lightly armed early tanks were not suited for fighting other tanks, and that putting high-velocity guns on even the PzKpfw III and PzKpfw IV would require major turret modifications. However, a large high-velocity antitank gun could easily be mounted on a turretless tank chassis or large half-track vehicle, thereby creating an open-ended architecture for future weapons growth. In 1935, Oberstleutnant Walter Nehring, the operations officer for Generalmajor Oswald Lutz's Inspectorate for Motor Transport Troops, developed an official requirement for self-propelled tank destroyers, although the ad hoc experimentation was confined to existing vehicles and weapons. It was not until war began in 1939 that the Heereswaffenamt put serious resources into this effort, by deciding to mount the Czech 4.7cm PaK 36(t) on the hulls of surplus PzKpfw I light tanks. The conversion effort began in the winter of 1939/40 at the Alkett facility in Berlin, which was a subsidiary of Rheinmetall. The resulting conversion was designated as the Panzerjäger I, and it was assigned to four army-level Panzerjäger battalions just in time for the French campaign in 1940. Although the vehicle was more than double the height of either the 3.7cm or 5cm PaK – and thus easier to spot – it could keep up with the Panzers and its 4.7cm gun could penetrate up to 47mm of armor at 500m. After the fall of France, the Heereswaffenamt ordered further development of self-propelled antitank guns, with an eye toward mounting 5cm and eventually 7.5cm antitank guns on surplus tank hulls, although no urgency was applied to this effort.

When the Wehrmacht began its modernization program in 1935, the 3.7cm PaK seemed adequate for the foreseeable future. There were still virtually no foreign heavy tanks in service and tanks heavier than 20 tons were still rare. When Hitler decided to send the Condor Legion to intervene in the Spanish Civil War, the 3.7cm PaK performed well against Soviet-built T-26 and BT-5 tanks. These 10–11-ton tanks, with no more than 15mm armor plate, proved vulnerable to standard *Panzergranate* shells from the 3.7cm PaK at ranges well beyond 500m. The Heereswaffenamt was aware of the Soviet T-35 heavy tank, but it was the introduction of the French H-35,

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The Germans began experimenting with antitank guns mounted on trucks in World War I and they expanded upon this tradition in World War II. The Panzerjäger I was created in early 1940 by mounting the Czech-built 4.7cm antitank gun on the hull of a PzKpfw I tank and these vehicles first saw combat in France. The Panzerjäger I was the primary German self-propelled antitank gun at the start of *Barbarossa*. (Nik Cornish at Stavka, WH 1088)

R-35 and SOMUA 35 tanks in 1935–36, followed by the 31-ton Char B1 *bis* in 1937, that caused the Germans to reconsider reliance on just the 3.7cm PaK. The new French infantry tanks had armor protection ranging from 30mm to 60mm, which reduced the effective range of the 3.7cm PaK to less than 500m. Consequently, the Heereswaffenamt issued a requirement for a 5cm antitank gun, with a contract awarded to Rheinmetall in May 1938. Rheinmetall's engineers decided to increase the length of the barrel as well as the diameter of the bore, but the basic configuration of the towed antitank gun remained the same. Although the Heereswaffenamt provided Rheinmetall with data on current French tanks, there was no information on current Soviet tanks. A prototype of the 5cm gun was available by August 1939 and firing tests indicated that the weapon could penetrate 57mm of armor at 500m, nearly doubling the penetration power of the 3.7cm PaK. The new weapon was standardized as the 5cm PaK 38, but limited production did not begin for another year. Soon after the war began, the Heereswaffenamt began discussions with both Rheinmetall and Krupp about developing a follow-on 7.5cm PaK gun to counter enemy heavy tanks, but no contracts were awarded.

The German engineer Hermann Gerlich perfected a tapered-bore design in the 1930s, which – when combined with tungsten-core ammunition – enabled lightweight antitank guns to achieve extraordinary muzzle velocity and penetration. The 2.8cm sPzB 41 was the first such weapon to enter service and limited numbers were available for Operation *Barbarossa*. Two larger tapered-bore weapons were in development that could enable the Wehrmacht to gain a decisive advantage in the contest between penetration and armor plate. (Ian Barter)

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The 5cm PaK 38 was regarded as the logical successor to the 3.7cm PaK after the French campaign, but Rheinmetall was unable to produce the weapon in quantity prior to Operation *Barbarossa*. When equipped with PzGr 40 tungsten-core ammunition, the PaK 38 had a limited ability to defeat KV heavy tanks. (Ian Barter)

Prior to Operation *Barbarossa*, Germany had perfected both tungsten penetrators and hollow-charge shells that could defeat heavy tanks, but neither was in widespread use since the threat of heavy tanks appeared negligible. However, once German troops encountered the KV-1 and T-34 tanks on the battlefield in June 1941 and discovered the ineffectiveness of their current PaK guns, the Heereswaffenamt initiated a frantic effort to develop new weapons or adapt existing ones to counter the threat. The resulting effort to upgrade the capabilities of German Panzerjäger units quickly was marked by garbled requirements and uncoordinated improvisation, which pushed for greater firepower but at the expense of protection and mobility.

Rheinmetall's 75mm PaK 40 would eventually become the primary defense against the KV heavy tank in 1942–43, although this was not immediately obvious in June 1941. Development of the PaK 40 was a low priority before *Barbarossa* and Rheinmetall could not design, test and build the new gun in much less than a year. (Ian Barter)

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THE STRATEGIC SITUATION

German Panzerjäger units gained a fair amount of combat experience against Allied medium and heavy tanks during the Western campaign of May–June 1940, but the level of threat was generally manageable. During the campaign, the German divisions had to rely upon the 3.7cm PaK (only recently equipped with PzGr 40 tungsten-core rounds) and four battalions of self-propelled 4.7cm guns with APC ammunition. Although none of the German antitank guns could penetrate the frontal armor of either the French Char B1 *bis* or British Matilda tanks much beyond 100m even with PzGr 40, the generally passive tactics of Allied tanks saved the Panzerjäger from humiliation, except at the battle of Arras. Since victory came so quickly, the inadequacy of German antitank weapons was not made apparent. The 5cm PaK 38 was tested after the campaign on French tank hulks and was judged to be more than adequate to deal with the likely future opposition.

By mid-June 1941, Germany had three army groups with 123 divisions poised to invade the Soviet Union in Operation *Barbarossa*. In addition to the division-level Panzerjäger battalions, there were 14 army-level Panzerjäger battalions equipped with the bulk of the available self-propelled guns. All told, the German forces had 9,000 antitank guns, including 7,782 3.7cm PaK, 216 4.7cm PaK 36(t), 783 5cm PaK 38 and 178 2.8cm sPzB 41. No HEAT ammunition was yet available and the 5cm PzGr 40 tungsten-core rounds for the PaK 38 only entered production a month before *Barbarossa*; they were so scarce that PaK gunners needed permission from regimental commanders to use them. Initially, the three primary German strategic

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objectives were Leningrad, Moscow and Kiev. The German Army invaded the Soviet Union with the arrogant belief that its weapons were as good as or superior to those of the Red Army. In fact, the German *Abwehr* (Military Intelligence) had done a poor job gathering information about the Red Army's tank force, underestimating both its quality and quantity. Although the Germans were aware of the T-35 heavy tank, the existence of both the KV and T-34 were unknown. Since the T-35 only had a maximum of only 30mm of armor and took years to develop, the *Abwehr* believed that Soviet industry would be unable to deploy better heavy tanks prior to Operation *Barbarossa*. Thus, the primary opposition was expected to come from thinly armored T-26 and BT-7 light tanks, which the Panzerjäger's 3.7cm and 5cm PaK could easily defeat. When this faith in German technical superiority was shattered on the second day of the invasion, the effect on German frontline morale was devastating.

At the start of the German invasion, the Red Army had roughly 24,000 tanks in its inventory, but only 5 percent were T-34s and 2 percent KVs. In the summer of 1941 the Red Army was in a period of rapid expansion after Stalin's decision in July 1940 to start forming mechanized corps. Once formed, these corps would each have a total of 126 KV and 420 T-34 tanks, making them greatly superior to German Panzer divisions, at least on paper. Over the course of less than a year, the heavy tank force expanded from three battalions to more than 20. By June 1941, ten tank divisions had received KV tanks, which enabled them to form 18 heavy tank battalions with a total of 433 KVs. Another 70 KVs were either in training units or not yet issued. However, only one-third of the KV battalions were near full strength in either equipment or personnel. Furthermore, the level of combat readiness among KV-equipped battalions in June 1941 was negligible, with most units lacking sufficient ammunition and fuel to conduct sustained operations. Personnel manning averaged 75 percent, with shortages of junior officers, NCOs and mechanics. Due to Marshal Kulik's interference, the production of both 76.2mm and 152mm tank ammunition had been minimal prior to the war and reserve stockpiles were non-existent. The lack of crew training was also a serious constraint, since only the KV battalions in the 8th Tank Division had been involved in the fall 1940 maneuvers; the remaining units had no training above company level. Most KVs, after delivery to units in the winter of 1940/41, were covered with tarpaulins in motor pools, to await summer maneuver training in 1941. Worst of all, the command and staff of the newly formed mechanized corps were unable to direct or sustain their tank units properly. Two-thirds of the frontline KV tanks were deployed in the Kiev Military District (see table on page 27). The 7th Tank Division was one of the few Red Army tank formations in relatively decent shape at the start of the war, with 50 KVs and 150 T-34s. Yet its tanks had only 1.5 loads of 76.2mm ammunition (only HE-FRAG, no APHE) and one load of diesel fuel on hand. Not surprisingly, the fuel ran out in the first two days of the war just moving to the front, after which the tanks were immobilized. The KV-2s in the 41st Tank Division didn't have a single shell between them and the drivers had not yet been trained. All of these deficiencies might still have been overcome had not Soviet war plans required the mechanized corps to launch immediate counterattacks in case of invasion, which robbed the KV battalions of any chance to prepare for combat.

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Table 1: Soviet KV order of battle, June 1941			
Unit	**Higher formation**	**Military district**	**Number of KV tanks**
1st Battalion/3rd Tank Regiment	2nd Tank Division, 3rd Mechanized Corps	Baltic	31 KV-1/KV-2
1st Battalion/4th Tank Regiment			19 KV-2
1st Battalion/7th Tank Regiment	4th Tank Division, 6th Mechanized Corps	Western	31
1st Battalion/8th Tank Regiment			31
1st Battalion/13th Tank Regiment	7th Tank Division, 6th Mechanized Corps		25
1st Battalion/14th Tank Regiment			25
1st Battalion/15th Tank Regiment	8th Tank Division, 4th Mechanized Corps	Kiev	25
1st Battalion/16th Tank Regiment			25
1st Battalion/19th Tank Regiment	10th Tank Division, 15th Mechanized Corps		31
1st Battalion/20th Tank Regiment			31
1st Battalion/63rd Tank Regiment	32nd Tank Division, 4th Mechanized Corps		18
1st Battalion/64th Tank Regiment			31
1st Battalion/67th Tank Regiment	34th Tank Division, 8th Mechanized Corps		51
1st Battalion/81st Tank Regiment	41st Tank Division, 22nd Mechanized Corps		16 KV-2
1st Battalion/82nd Tank Regiment			15 KV-2
1st Battalion/23rd Tank Regiment	12th Tank Division, 8th Mechanized Corps		9
1st Battalion/24th Tank Regiment			9
1st Battalion/21st Tank Regiment	11th Tank Division, 2nd Mechanized Corps	Odessa	10
TOTAL			**433**

Once the Wehrmacht became aware of the KV heavy tank, the realization that the Red Army could produce tanks that were virtually immune to standard Panzerjäger

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weaponry led to hesitation among some German operational-level commanders. The KVs posed a threat both on the offense and in defense due to their near-invulnerability and even small numbers of them could act as hindrances and deterrents to the German ability to advance. Reports that enemy "52-ton tanks" were in the vicinity prompted German commanders to shift from offense to hasty defense, in anticipation of major counterattacks, or to advance more cautiously. Wherever KVs showed up in any strength, the German advance tended to slow down.

In theory, two existing German weapons could counter the KV heavy tank, but in reality these were not practical solutions. Both the 8.8cm Flak 18/36 antiaircraft gun and the *schwere* 10cm K18 cannon demonstrated their ability to damage or destroy KV tanks at ranges of 500m with AP or APHE ammunition. In June 1941, the Germans deployed 622 8.8cm Flak guns and 300 10cm cannon with the invasion force, which seemed adequate to deal with any enemy heavy tanks. However, both these weapons weighed over 5 tons and were more than double the height of the 5cm PaK, which meant they required a large SdKfz 7 half-track to move them into position. Unless they were already in position, these large, conspicuous weapons could not safely move to the forward edge of the battlefield to engage Soviet tanks without risk of detection and once spotted, heavy artillery had no real protection. Furthermore, since both Flak and heavy artillery were usually well to the rear, their response time to move to counter KV-1 attacks typically required hours.

If Germany had possessed enough tungsten carbide, the threat posed by KV heavy tanks and T-34s might have evaporated rather quickly. Prior to *Barbarossa*, Germany had only used about 100 tons of tungsten ore annually for antitank ammunition, but this figure increased 800 percent after encounters with Soviet heavy tanks. Germany was totally dependent upon foreign suppliers for access to tungsten ore. During 1941–42, Germany annually received 3,100 tons or 90 percent of its tungsten ore requirement from Spain and Portugal. Allied economic warfare successfully managed to pressure Spain and Portugal to restrict tungsten exports to the Third Reich just as demand rose exponentially. When Albert Speer took over as Minister of Armaments in February 1942, he realized that Germany's small reserves of tungsten were being rapidly consumed by the Panzerjäger on the Eastern Front, leaving little for use in machine tools needed to produce the weapons. Speer was able to convince Hitler to choose between antitank ammunition and machine tools. In June 1942, Hitler decreed that no more tungsten would be used for antitank ammunition, with a temporary exception granted to 5cm PzGr 40 ammunition since that was still the primary division-level antitank weapon. Much of the existing hard-core ammunition was

A 5cm PaK 38 being towed through a stream in Russia. The German Panzerjäger units were expected to keep up with the advance units, but most of their prime movers were designed for European roads, not the muddy tracks in Russia. (Ian Barter)

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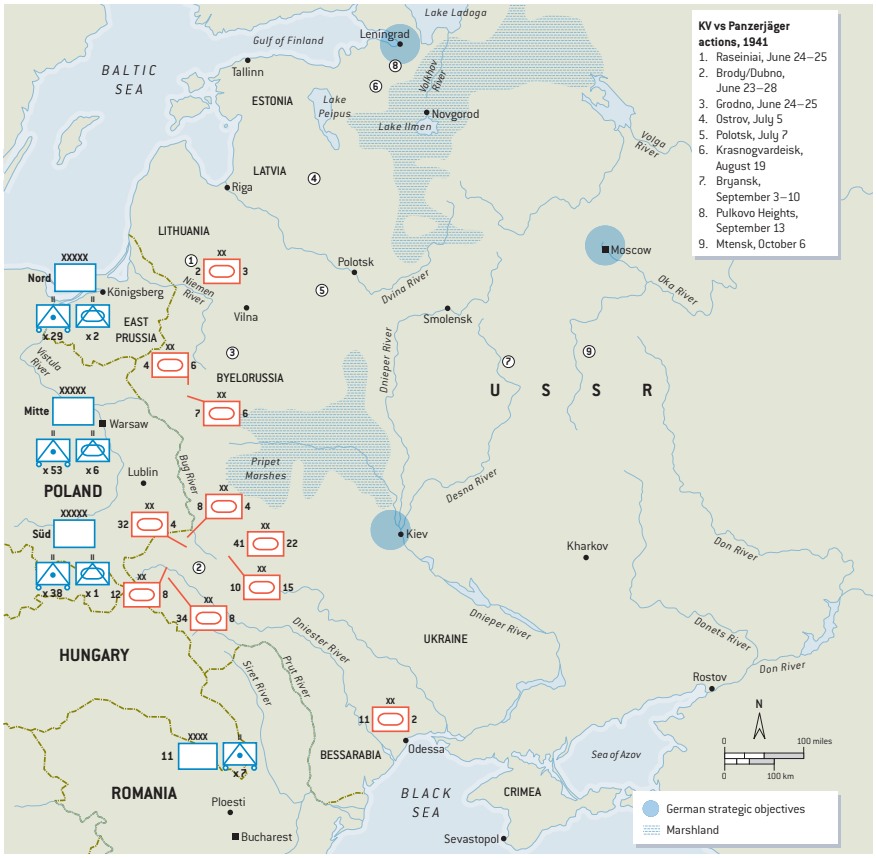

The opening stages

This map depicts the opposing dispositions of German Panzerjäger-Abteilungen and Soviet KV-equipped battalions in the opening stages of the war in the East, as well as the three main German strategic objectives. The map also depicts the location of the most important Panzerjäger vs KV tank actions in the 1941 campaign, which indicates that most occurred in the border areas and on the approaches to Leningrad.

also ordered to be turned in for disassembly in order to recover tungsten, which must have done wonders for the morale of frontline Panzerjäger. Thereafter, larger PaK guns and HEAT ammunition became the preferred solution to the problem posed by Soviet heavy tanks.

German troops pulling a 3.7cm PaK up an icy slope during the winter of 1941/42. Although the weapon was clearly overmatched by the KV-1, the OKH was forced to retain the 3.7cm PaK well into 1943 due to Rheinmetall's inability to fully reequip the Panzerjäger with better weapons. (Ian Barter)

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TECHNICAL SPECIFICATIONS

SOVIET KV HEAVY TANKS, 1941

Once GABTU approved production of the KV heavy tank, the Red Army specified an initial order of 3,800. The Kirov plant in Leningrad built three models of KV-1 tanks in 1940–41 and the Chelyabinsk Tractor Factory built two improved models in 1941–43. Two models of the KV-2 tank were also built at the Kirov plant between February 1940 and October 1941, when production ceased. Altogether, about 4,220 KV-1 and 204 KV-2 heavy tanks were built. These models in brief were:

KV-1 MODEL 1939

About 106 of the original model were built from June until October 1940. It weighed 43.5 tons and was armed with the short 76.2mm L-11 gun. Armor protection was 75–90mm on the turret and the hull.

KV-1 MODEL 1940

About 296 were built from November 1940 until June 1941. The main improvement was the better 76.2mm F-32 gun. About one-third were built with additional bolt-on armor plates on the hull and turret, which increased protection up to 110mm but also raised the weight by 4 tons.

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KV-1 MODEL 1941

Over 700 were built from July to December 1941 and armed with the long 76.2mm ZIS-5 gun (F-34) in a cast turret. The tank weighed 45 tons and armor protection was 90–110mm on the hull and 100–110mm on the turret.

KV-1 MODEL 1942

Over 1,500 were built from January to August 1942 and retained the 76.2mm ZIS-5 gun. Armor protection was augmented to 90–130mm on the hull and 100–120mm on the turret, which increased the weight to 47 tons. Off-road speed decreased to 13km/h (8mph).

KV-1S

Over 1,300 were built from August 1942 to March 1943. Stalin wanted the KV to have better mobility so the GABTU ordered Kotin to shave 5 tons off the gross weight. Although the KV-1S ("speedy") had an improved off-road speed of 24km/h (15mph), it was still significantly slower than the T-34 and came at the expense of decreasing armor protection, which was reduced to 60–75mm on the hull and 82mm on a smaller turret.

KV-2 MODEL 1940 (*BOL'SHOY BASHNY*/"BIG TURRET")

An initial batch of 24 assault tanks was built from February to August 1940. However, these early models were too top-heavy to be issued to field units. The KV-2 weighed 52 tons and was armed with the 152mm M-10T howitzer in a huge turret. It had a top road speed of only 26km/h (16mph) and had armor protection of 75mm on the hull and 75–110mm on the turret. The KV-2 was primarily intended as a bunker-busting assault tank.

KV-2 MODEL 1941 (*PONIZHENNOY BASHNY*/"LOWERED TURRET")

A total of 180 improved KVs with 152mm howitzers were built between November 1940 and June 1941. This model added minor refinements, such as a hull machine gun and additional armor protection, which increased the weight by up to 4 tons on some variants.

KV-1 tanks being assembled at the Chelyabinsk plant, spring 1942. The CTZ plant began producing KV tanks in July 1941 and hit peak production in May 1942, with 325 rolling out that month. (Author)

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GERMAN ANTITANK WEAPONS, 1941

Rheinmetall was the only German company designing large antitank weapons at the start of World War II. At the start of Operation *Barbarossa*, the primary antitank weapons in production were:

2.8cm sPzB 41

Although classified as an antitank rifle, the sPzB 41 was a sophisticated light antitank gun using the tapered-bore principle to fire tungsten-core penetrators. The Mauser-Werke began testing this weapon in July 1940 and almost 200 had been built by the beginning of Operation *Barbarossa*.

3.7cm PaK 36[5]

This was the Wehrmacht's primary antitank weapon at the start of Operation *Barbarossa*. Rheinmetall had built over 11,000 by June 1941, although production was beginning to taper off in favor of the PaK 38. Using PzGr 39 rounds, its best penetration was 35mm at 100m, which was totally ineffective against the KV-1's armor. PzGr 40 tungsten-core rounds for 3.7cm entered production in 1940, but only limited quantities had been issued by June 1941 due to the high cost of production. Even with these rounds, a 3.7cm PaK could only damage a KV when fired from the rear arc at ranges of just 20–30m. Few gun crews had the nerves for this kind of engagement.

4.7cm PaK 36(t)

Owing to its excellent performance, the Germans kept the Skoda-built 4.7cm antitank gun in limited production into 1942. While its standard armor-piercing rounds could only penetrate 52mm at 100m, the 4.7cm PzGr 40 round issued in July 1940 could penetrate 100mm at 100m, which was the best performance of any Panzerjäger weapon in June 1941.

5 The official designation of this weapon in 1941–43 was the 3.7cm PaK, but after the war it was widely described as the 3.7cm PaK 36.

Rheinmetall's 5cm PaK 38 was more than twice the weight of the 3.7cm PaK and represented something of a compromise between mobility and firepower. In June 1941, the Wehrmacht believed that the PaK 38 was the best antitank gun in the world. (Author)

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5cm PaK 38

This was the Wehrmacht replacement for the 3.7cm PaK and it entered low-rate production in April 1940. However, Rheinmetall experienced production difficulties establishing the PaK 38 production line in Düsseldorf, with a monthly output of less than 100 PaK guns throughout 1940. It was not until April 1941 that production finally reached 150 guns per month, so that by June Rheinmetall had built over 1,200 PaK 38s. The PaK 38 guns used in the initial invasion were primarily armed with standard PzGr 39 rounds, whose best penetration was 69mm at 100m.

7.5cm Gr 38 HI/A HEAT ammunition entered low-rate production for testing in August 1940 and offered a potential solution to the threat posed by Soviet heavy tanks. However, since the Panzerjäger did not have a 7.5cm gun to fire the hollow-charge rounds, no HEAT ammunition was issued to Panzerjäger units until early 1942. A 7.5cm HEAT round was later issued for the 7.5cm IG 18 infantry howitzer, providing additional antitank capability for infantry regiments.

Table 2: German Panzerjäger weapons by entry into service

Weapon	Entered service	Combat weight	Height	Rate of fire	Cost	Barrel life
3.7cm PaK 36	1936	440kg	1.17m	15–18 rds/min	5,730 RM	4,000–5,000 rds
4.7cm PaK 36(t)	1939	590kg	1.14m	16–20 rds/min	N/A	N/A
2.8cm sPzB 41	1940	223kg	0.83m	22 rds/min	4,500 RM	500 rds
5cm PaK 38	1940	986kg	1.1m	12–14 rds/min	8,000 RM	4,000–5,000 rds
4.2cm PaK 41	1942	642kg	1.17m	10–12 rds/min	7,800 RM	1,000 rds
7.5cm PaK 40	1942	1,425kg	1.25m	11–14 rds/min	12,000 RM	6,000 rds
7.5cm PaK 41	1942	1,356kg	1.8m	13 rds/min	15,000 RM	600–1,000 rds
7.5cm PaK 97/38	1942	1,190kg	1.05m	10–14 rds/min	8,000 RM	N/A
7.62cm PaK 36(r)	1942	1,730kg	1.22m	10–12 rds/min	N/A	6,000 rds
8.8cm PaK 43	1943	3,700kg	1.98m	6–10 rds/min	26,000 RM	2,000 rds

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Three other antitank weapons were under development in June 1941, but the Heereswaffenamt had not placed any orders. Each of these new PaK guns was specifically intended to counter enemy heavy tanks, such as the French Char B1 *bis*:

4.2cm PaK 41

Expanding upon the tapered-bore principle, the PaK 41 mounted a 4.2cm tapered-bore barrel manufactured by Billerer & Künz in Aschersleben on a Rheinmetall-built PaK 36 carriage, in order to significantly increase armor penetration capabilities without sacrificing mobility. The PaK 41 did not enter low-rate production until December 1941 when 37 were built, followed by another 276. Production was terminated in June 1942. The PaK 41's PzGr 41 tungsten-core round had excellent performance for its size and could penetrate up to 87mm of armor at 500m, which threatened the KV's side armor. However, only 115 PaK 41s were issued to Luftwaffe Fallschirmjäger units and 25 to the Waffen-SS, which meant that this excellent weapon saw limited service on the Eastern Front.

7.5cm PaK 40

Rheinmetall began developing a 7.5cm antitank gun in 1939, but this project was a low priority until the discovery of the KV-1. However, after the initial encounters with the KV-1 and T-34, *Reichsminister* Fritz Todt moved the PaK 40 project to the front of the line and a prototype was completed by November 1941. After brief testing, low-rate production began in April 1942. A total of 2,114 PaK 40 were built in 1942 and 8,740 in 1943. Using standard PzGr 39 armor-piercing rounds, the PaK 40 could destroy KV-1 tanks at ranges of about 500m.

7.5cm PaK 41

Krupp had also begun developing a 7.5cm antitank gun prior to *Barbarossa*, but their design utilized a tapered-bore barrel to produce much higher muzzle velocities than Rheinmetall's PaK 40. The first PaK 41s were delivered in April 1942 and the Krupp gun had significantly better penetration than Rheinmetall's PaK 40; the PaK 41 could penetrate KV-1 frontal armor out to 2,000m. However, the PaK 41 was an expensive weapon that relied upon tungsten-core penetrators, so only 150 were built before the weapon was phased out.

Although the Panzerjäger were still reliant on towed, lightweight PaK guns at the start of *Barbarossa*, the German Army recognized that army-level Panzerjäger units needed self-propelled antitank guns to keep up with fast-moving offensive operations. Two self-propelled weapon systems were in service by June 1941:

PANZERJÄGER I (SdKfz 101)

Some 202 Czech-built 4.7cm PaK 36(t) antitank guns were mounted on PzKpfw I chassis during March 1940–February 1941, providing German Panzerjäger with their first self-propelled antitank gun.

PANZERJÄGER I Ausf 35R

Another 174 Czech 4.7cm PaK guns were mounted on French R35 light tank chassis in May–October 1941. The Renault R35 proved a poor choice as a chassis and

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the converted weapon lacked the reliability of its predecessor.

Once the Wehrmacht became aware of the near-invulnerability of the KV-1 and T-34 to its existing antitank weapons, there was an immediate push to counter these new enemy tanks. Fritz Todt's *Reichministerium für Rüstung und Kriegsproduktion* (Reich Ministry for Armaments and War Production) pushed a bewildering array of antitank programs through the Heereswaffenamt after June 1941 to counter the KV-1 and T-34 tanks. In addition to expediting the Krupp and Rheinmetall 7.5cm PaK projects, Todt authorized multiple ad hoc and poorly coordinated interim solutions, which threw Russian guns, French guns, Czech and French tank chassis and untested German technology into a mixing bowl to come up with a quick response to the KV-1. The fact that both of the primary "quick-fix" solutions to the KV relied upon captured weapons demonstrates that the Germans had been caught on the wrong side of a serious technological imbalance.

One foreign-built antitank gun rushed into service was the PaK 97/38. Based upon a French 75mm gun mounted on a German gun carriage and firing HEAT ammunition, the PaK 97/38 was cheap, available, and provided a modicum of defense against Soviet heavy tanks. (Ian Barter)

7.5cm PaK 97/38

In an effort to get a weapon that could fire the 7.5cm Gr 38 HI/A (HEAT) shells against enemy tanks as rapidly as possible, Rheinmetall decided to mount the barrels of captured French 75mm cannon on its carriage for the PaK 38. A muzzle brake was added to the barrel to stabilize the weapon. The PaK 97/38 was 25 percent less expensive than the PaK 40 and Rheinmetall was able to convert 2,854 in 1942. The first PaK 97/38 reached the Eastern Front in mid-1942. Although the PaK 97/38 had an effective antitank range of only 500m, its HEAT rounds could penetrate 75mm of armor, which gave the gun a credible capability against the KV-1's side armor. However, normal engagements usually required at least five rounds per target. Since the PaK 97/38 had no tracer rounds, it was difficult for the crew to determine whether or not they had scored a hit.

The Germans pressed large numbers of captured 76.2mm F-22 guns into service as antitank weapons. Once upgraded with a lowered profile and the ability to use German-produced ammunition, the 7.62cm PaK 36(r) became one of the Panzerjäger's best means of defeating the KV-1 in 1942. (Ian Barter)

7.62cm PaK 36(r)

The German Army began using captured Soviet 76.2mm F-22 guns against Soviet heavy tanks as early as July 1941, but there were a number of problems with this approach, not least of which was a reliable supply of ammunition. Rheinmetall was tasked to rechamber the captured weapons to use 7.5cm PaK 40 ammunition and conduct other modifications to suit German standards. The first PaK 36(r) reached the front in February 1942, followed by 357 more that year. Using both HEAT and armor-piercing ammunition, the PaK 36(r) could penetrate the KV-1's armor at ranges up to 500m.

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Yet even as the Heereswaffenamt pushed forward the various heavy PaK gun projects, it was digesting reports from the early engagements with KVs which indicated that it was difficult to reposition large, towed PaK guns on the battlefield when in contact with enemy armor. Thus, the Heereswaffenamt concluded that some of the heavy PaK guns should be mounted on self-propelled mounts. Based upon lessons learned from the Panzerjäger I series, Rheinmetall teamed up with the firm of Alkett and others in December 1941 to begin converting surplus PzKpfw II and PzKpfw 38(t) hulls to carry the new generation of heavy PaK guns, beginning with the PaK 40 and PaK 36(r). This approach had the advantages of expediency and the ability to upgrade the main gun without waiting for larger turrets to be designed. The resulting self-propelled heavy PaK guns were dubbed the *Marder* (Marten) series and began appearing in April 1942, deployed as companies.

MARDER II (SdKfz 132)

Alkett mounted a Soviet 76.2mm gun on a PzKpfw II tank chassis. The first *Marder* II appeared in April 1942, with 344 built by the end of the year.

MARDER III (SdKfz 139)

Another batch of 344 Soviet 76.2mm guns were mounted on a Czech PzKpfw 38(t) tank chassis.

MARDER II (SdKfz 131)

A 7.5cm PaK 40 was mounted on a PzKpfw II tank chassis. It first appeared in June 1942, with 576 built by June 1943.

MARDER I (SdKfz 135)

A 7.5cm PaK 40 mounted on a French *Chenillette* (Little Caterpillar) Lorraine chassis. A total of 170 were completed in July–August 1942.

MARDER III (SdKfz 138)

A 7.5cm PaK 40 mounted on a Czech PzKpfw 38(t) tank chassis. It first appeared in November 1942, with 110 built in 1942 and 618 in 1943.

Despite its height, the *Marder* II Ausf D–E with 7.62cm gun was the best self-propelled Panzerjäger weapon available during Operation *Blue*. On the open steppe, *Marder* IIs could successfully engage KV-1 tanks at 500–600m. (Ian Barter)

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The *Stielgranate* 41 HEAT warhead was deployed as a stopgap solution to provide the 3.7cm PaK with some capability against the KV-1 and T-34 tanks. While the HEAT warhead could burn through the KV's thick armor, the weapon was highly inaccurate and had a practical range of only about 100m. (Author)

In addition to the new heavy PaK guns, the Heereswaffenamt sought to leverage the German development of HEAT ammunition to upgrade existing 3.7cm and 5cm PaK guns to provide at least a limited anti-KV capability, as well as to provide a last-ditch weapon for the infantry. A stick grenade mounting a hollow-charge warhead was developed for both of the existing PaK guns and began to arrive at the front in early 1942. The 3.7cm *Stielgranate* 41 provided the PaK 36 with an ability to knock out KV-1 tanks at ranges of about 130m; however, the round had poor flight characteristics and was thus not very accurate. The *Stielgranate* proved useful for finishing off immobilized KVs, but it was less well suited to engaging moving targets. Nevertheless, over 600,000 *Stielgranaten* were produced in 1942. For the infantry, the *Hafthohlladung* magnetic shaped-charge antitank mine was first issued in May 1942. Although a desperation weapon that had to be emplaced by hand, the 3kg charge provided German infantry with the means to disable Soviet heavy tanks. While more than 600,000 were built in 1942–43, magnetic mines accounted for only about 1 percent of tank "kills."

The "duel" between German Panzerjäger and the KV heavy tanks was shaped by three main characteristics: firepower, protection and mobility. Initially, the KVs enjoyed a one-sided advantage in terms of firepower and protection, but the Panzerjäger had superior mobility. The Germans redressed the imbalance in firepower by mid-1942, but the KV remained a tough tank to destroy until mid-1943.

FIREPOWER

In order to destroy a target on the battlefields of 1941–43, the firing platform needed to be able to detect that target and engage it with appropriate ammunition. Spotting the enemy first and shooting first conferred a significant advantage. The KV heavy tanks had the ability to destroy all forms of towed and self-propelled Panzerjäger throughout the period of 1941–43. Against towed PaK guns, the 76.2mm OF-350 HE-FRAG round was the weapon of choice, followed up by 7.62mm coaxial machine-gun fire. The OF-350 was a point-detonating round with a relatively small bursting charge, which made it less than ideal for destroying small, concealed PaK guns. However, if the weapon could be identified, its destruction was almost certain. KV tankers also took great pleasure in crushing PaK guns beneath their tracks. Against

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KV AMMUNITION

KV-1 crews used the BR-350 APHE round (**1**) and the OF-350 HE-FRAG round (**2**).

thinly protected self-propelled guns, the OF-350 was more effective, although the BR-350A APHE round could also suffice. For the KV-1 tankers, the main problem was spotting the PaK gun, which was very difficult to see from inside a buttoned-up tank with poor external visibility. The gunner's TMFD-7 sight had only a 15-degree field of view, which made scanning for targets time-consuming. The commander's PTK-5 panoramic sight had a wider field of view, but it had a serious blind spot on the left side of the turret and to the rear. While the rear-firing 7.62mm DT machine gun might cover the rear arc, the more astute Panzerjäger soon learned that the KV-1 was virtually blind from its left rear quarter. In addition, the KV-1 had a much lower rate of fire versus most PaK guns – 4–8 rounds/min compared with 12 or more rounds per minute for most PaK guns. Thus, concealed PaK guns usually managed to get in several shots before the KV-1 could even respond.

GERMAN PaK AMMUNITION, 1941–43

In less than two years, the Panzerjäger on the Eastern Front went from firing 0.68kg 3.7cm armor-piercing shells to firing 10.4kg 8.8cm shells. The following is not meant to be a complete list of all antitank rounds used by Panzerjäger units on the Eastern Front in 1941–43 – which included an exotic array of captured and experimental shells – but the primary ones.

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Caliber	Round	Projectile weight	Muzzle velocity	Penetration (mm)				
				100m	500m	1,000m	1,500m	2,000m
3.7cm	PzGr AP (**1**)	0.68kg	762m/s	50	36	22	–	–
	PzGr 40 APCR* (**2**)	0.35kg	1,030m/s	68	40	–	–	–
	Stielgranate 41 HEAT (**3**)	8.6kg	110m/s	180	180	–	–	–
4.2cm	PzGr 41* (**4**)	.336kg	1,265m/s	90	72	53	–	–
4.7cm	PzGr 39 (**5**)				47			
	PzGr 40 (**6**)				58			
5cm	PzGr 39 (**7**)	2.25kg	823m/s	68	60	48	35	–
	PzGr 40* (**8**)	0.85kg	1,198m/s	116**†	80	55	–	–
7.5cm PaK 40	PzGr 39 AP (**9**)	6.8kg	792m/s	120**	104**	89	76	–
	PzGr 40 APCR* (**10**)	3.2kg	990m/s	135** †	115**†	96	80	–
7.5cm PaK 40, PaK 97/38, PaK 36(r)	Gr 38 HI/B HEAT (**11**)	4.57kg	450m/s	75	75	75	–	–
7.5cm PaK 41	PzGr 41 HK* (**12**)	2.59kg	1,125m/s	183**†	171**†	145**†	122**†	102
7.62cm PaK 36(r)	PzGr 39 (**13**)	7.54kg	740m/s	106	98	88	79	71
	PzGr 40* (**14**)	4.0kg	990m/s	145**†	118**†	92	71	55
8.8cm PaK 43	PzGr 39 (**15**)	10.4kg	1,000m/s	202**	182**	167**	153**	139**
	PzGr 40* (**16**)	7.3kg	1,130m/s	237**†	226**†	192**†	162**†	136**†
	Gr 39 HI HEAT (**17**)	7.65kg	880m/s	90	90	90	–	–

* Tungsten-core penetrator.

** Able to penetrate frontal armor of KV-1 (100–110mm @ 60–75-degree slope).

† Owing to tungsten-carbide penetrators.

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A 5cm PaK 38 crew knocking out a T-34 with side shots from a range of just 20m. This photo demonstrates the point-blank nature of the Panzerjäger duel with Soviet heavy and medium tanks in the summer of 1941. In order for this tactic to work, commanders had to accept Soviet tanks advancing into their positions. (Author)

From the German perspective, the Panzerjäger had grossly insufficient firepower throughout the summer 1941 and winter 1941/42 campaigns. The standard load for a 3.7cm PaK was 250 rounds, of which only 30 were PzGr 40, while the 5cm PaK had 220 rounds, of which 150 were PzGr 39 and 40 PzGr 40. Thus at best, only about 15 percent of the German PaK ammunition had any chance of inflicting damage on a KV tank. With standard PzGr 39 antitank rounds, the 3.7cm, 4.7cm and 5cm guns had negligible probability of seriously damaging a KV even if fired from directly behind the vehicle at ranges of 20–50m. If the tank's final drive wheel or thin belly armor could be hit from this angle, the KV might be immobilized. Of course, the trick was getting a PaK gun into position behind a heavy tank, which was impossible if the KVs had any infantry support on hand. When equipped with PzGr 40 tungsten-core rounds, the situation improved slightly for the 5cm PaK 38, which could inflict damage up to several hundred meters away and possibly on the hull side. However, tungsten-core rounds were not available in quantity at the start of *Barbarossa* and HEAT ammunition had not yet been issued to Panzerjäger units.

Although the KV consistently enjoyed an advantage in destroying its antitank opponents if detected, the Panzerjäger did not gain a reliable capability to engage the KV-1 successfully until the arrival of the first 7.62cm PaK 36(r) in February 1942. This capability was reinforced by the introduction of the 7.5cm PaK 97/38 and 7.5cm PaK 40 into service by mid-1942. The mass production of HEAT ammunition for Panzerjäger and artillery units also added great punch to German antitank capabilities by mid-1942. However, HEAT warheads were generally only effective up to 500m and did not yield a high kill probability, requiring multiple rounds fired. When armed only with standard armor-piercing rounds, no German antitank gun could reliably penetrate a KV-1 at normal battlefield ranges until late 1943.

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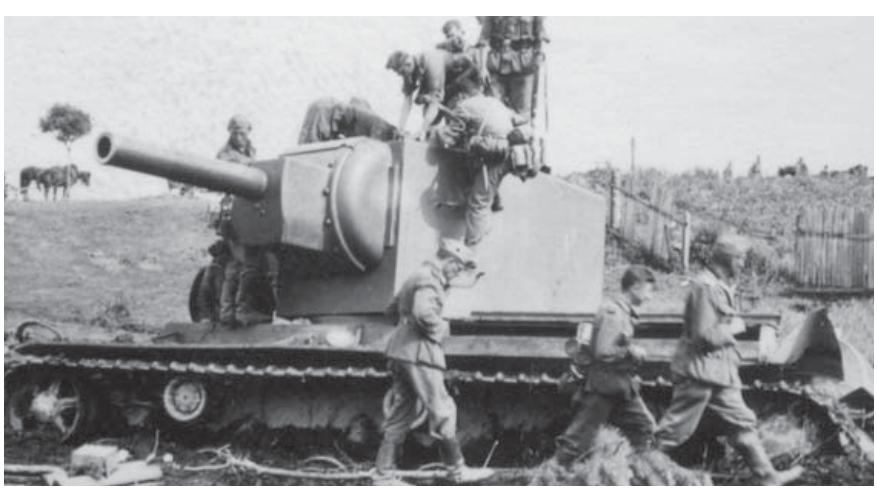
MOBILITY

The KV-1/KV-2 models of 1940–41 had very poor mobility due to inadequate transmissions and horsepower-weight, which greatly reduced their impact on the battlefield. Faulty clutches also made some KV tanks virtually unsteerable, which even occurred in front of Stalin during the parade in Moscow on November 7, 1941. KV transmissions tended to fail after as little as 800km (500mi) of road marching. Unlike the T-34 tank, which had its mobility well tested by Koshkin during road trials in 1940, the KV entered service after negligible testing and operators soon found out that it could move only short distances without breaking down. In combat, KVs typically advanced at speeds of only 3–4km/h (2–2.5mph), which made them large, slow-moving targets. Their top off-road speed was 16km/h (10mph) and their turning radius was poor. The KV did very poorly on marshy or soft ground, with many lost simply because they became stuck in the mud – no way for a superior weapon to perish. Simply put, the early KV models did not have adequate mobility to conduct their breakthrough role successfully. Retreats were also very hard on KVs, with many being lost or abandoned because of a plethora of mobility issues (such as difficulty in crossing bridges or handling hilly terrain). Eventually, the introduction of the KV-1S model in 1942 and further refinements gradually improved the KV's mobility to the point where it could accomplish its breakthrough mission, although by then improved German Panzerjäger capabilities made that increasingly problematic.

The Panzerjäger of 1941 had excellent tactical and operational mobility due to the small size of their weapons, although very few were self-propelled. However, many prime movers were lost in the first six months of the campaign and horses were often substituted, which reduced the mobility of division-level PaK guns. During 1942, the dynamic began to change from reliance on small, towed weapons to bigger, self-propelled guns. The towed guns such as the 7.5cm PaK 40 proved too heavy and large for frontline combat and so despite this gun's armor-piercing capabilities, it suffered heavy losses in 1942–43. Eventually, the German antitank defenses after mid-1943 became increasingly reliant upon small numbers of self-propelled heavy PaK guns, which could be rushed from one threatened sector to the next.



A KV-2 stuck in the mud and abandoned. In June 1941, few KV drivers were trained and those that were had practiced on light tankettes, which handled very differently. Consequently, many KVs were lost trying to move across unsuitable terrain. (Ian Barter)

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Even when PaK guns could engage the KV-1 at close range, penetration was not assured. Here, a 5cm antitank round hit the side of the turret of this KV-1 but could not penetrate the 30mm bolt-on armor. Note that the armor plate is cracked and deformed. (Author)

PROTECTION

The KV-1 was the best-protected tank in the world in 1941; virtually invulnerable to German Panzerjäger weaponry for the first seven months of the war in the East. One of its few weaknesses lay in the turret ring, which could be jammed by impact damage from large-caliber rounds. The panoramic sight could also be damaged by direct fire, thereby greatly reducing the KV's ability to locate targets. Gradually, the KV's advantage in self-protection began to erode, despite additional armor on the KV-1, as the penetration performance of Panzerjäger weaponry improved. The introduction of the KV-1S model abandoned the over-reliance on armor protection in favor of regaining mobility, which made the KV-1 more vulnerable to German heavy PaK guns by late 1942.

In 1941, the Panzerjäger derived their protection not from armor plate but from the low silhouettes of their towed guns, which were difficult to spot beyond a few hundred meters. If their PaK gun was spotted, both the crew and the gun itself had little chance of survival against a KV-1. Yet as the PaK guns grew bigger in 1942–43, it became more difficult to conceal them – and the self-propelled guns were just as visible as tanks, but without the armor plate. As the level of protection afforded by concealment dwindled, the up-gunned Panzerjäger units were forced to deploy further back from the frontline, lest they be identified and targeted by Soviet artillery. All Panzerjäger weapons in 1941–43 were at risk from high-explosive and even machine-gun fire. Gun shields on both towed and self-propelled weapons offered protection against only shell splinters and small-arms fire, but crews were entirely exposed if attacked from overhead or the rear.

A KV-1 destroyed on the steppe during the battle of the Don Bend in August 1942. This tank has been hit at least 20 times, but appears to have only a single penetration on the turret. (Bundesarchiv, Bild 169-0441)

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THE COMBATANTS

THE SOVIETS

The Red Army formed its first heavy tank unit, the 5th Heavy Tank Regiment, in 1935. This unit was expanded to brigade-size as more T-35s were built and eventually comprised three tank battalions and one training battalion by 1939. When the KV-1 tank entered service in 1940, additional training units were set up at Saratov and Orel, as well as a technical training course for driver–mechanics at the Kirov plant. Prior to the war, the Red Army had a requirement to create 36 heavy tank battalions, with each of the 18 tank divisions to receive two heavy tank battalions, each with 31 KV tanks. Altogether, the Red Army intended to train more than 5,000 KV tankers but despite efforts to rush new recruits through training, barely 600 had gone through basic training by June 1941. Only 17 battalions were in existence, none of which were combat-ready. In order to protect the KVs from unnecessary wear and tear, the General Staff had directed that driver training would be conducted on obsolete T-27 tankettes, rather than the new KVs. Thus, by June 1941 most KV drivers had only 3–5 hours' worth of experience, and on dissimilar machines. Junior officers often didn't know how to read maps and often led their platoons into ground that was too marshy for the KV, causing many tanks to become bogged down. Battalions in the western military districts had plenty of new recruits but were missing 25–50 percent of their officers and NCOs.

Most KV tankers were draftees, but in the early stages of the war – when there was a surge of patriotism – there were volunteers attracted to serving on heavy tanks. The

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Red Army tended to select better-educated recruits, usually high-school graduates with follow-on automotive training or experience, for service in heavy tank units. Pre-war training was typically one year long for those on track to get commissions as junior officers, although NCO and junior enlisted training was about half that. Motivations among recruits varied immensely and the recent purges had an effect on morale; KV trainee Arseni Rod'kin recalled that his uncle had been arrested in the purges and subsequently died in prison, which affected his attitude toward the regime he served. Rod'kin later said that: "The Kremlin bastards come and go, but the Motherland is forever … I was defending my country, not the Soviets."

Once the German invasion began, both production of KVs and training of crews were disrupted. When the Kirov plant relocated to Chelyabinsk in October 1941, most KV training was also shifted there. A reserve tank training regiment was created at Chelyabinsk to conduct training, but for much of 1942 it had only two KV tanks and a few other types. Oftentimes, training was conducted on substitutes or even on foot. The period of training was reduced to eight months for officers and three months for junior NCOs. Unlike the German method, trainees were not formed into permanent crews during training, but only when they reached their operational unit. Most Soviet tankers recall that training was unrealistic and did little to prepare them for combat. Gunnery training was mostly limited to sub-caliber substitutes, namely firing a machine gun through the main gun barrel. Training against their primary opponent – concealed enemy antitank guns – was non-existent, although there was some discussion about engaging bunkers. Most KV commanders were unprepared for how little visibility they would have when buttoned-up in combat and how to work with supporting infantry, which proved quite detrimental on the battlefield. Driver training was also minimal, which meant no practical instruction on proper use of terrain for concealed movement. Instead, trainees were given large doses of mindless drills, such as loading and unloading dummy rounds into the breach, as well as hours of Communist indoctrination.

The five-man crew of the KV-1 consisted of a commander (leytenant), gunner, driver-mechanic (leytenant), auxiliary driver and radio-operator. The KV-2 had a sixth crewman added, to serve as the loader for the 152mm gun. Initially, the heavy tank battalion of 1941 was supposed to have a headquarters element with one KV tank and three companies of ten KVs each, but only six KV battalions were at full strength at the start of the German invasion. Losses in the first four weeks of combat were catastrophic. By July 1941, most surviving KVs were integrated into mixed tank battalions with T-34s, usually in company-sized groups of 7–10 tanks. By December 1941, a Soviet tank brigade was authorized only

Soviet tankers uploading ammunition onto a KV-1 in summer 1942. The caliber of individual Soviet tankers was much higher in the second year of the war, with far fewer tanks lost to inferior driving, navigation, or maintenance skills. (Author)

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five KVs in a single half-company. Throughout much of the winter counteroffensive of 1941/42, KVs served in independent tank battalions, but only in small numbers. By mid-1942, enough KVs were available to begin re-forming larger units, beginning with army-level heavy tank regiments. Unfortunately, these regiments were often spread around between different fronts, so that there was no mass of heavy tanks concentrated in one sector to fulfill their intended breakthrough role. Throughout much of 1941–43, KVs tended to fight in platoon-size formations of 3–4 tanks.

KV-1 crews in one of the independent heavy tank regiments in the 2nd Guards Tank Army, summer 1943. By the third year of the war, KV-1 crews had finally been sharpened into a professional force, but their tanks were no longer technically superior. (Fonds of the RGKFD)

THE GERMANS

When the Wehrmacht was created in 1935, the Panzerjäger were formed as a separate branch of service. From the beginning, the Panzerjäger were considered an elite and tended to draw upon the best personnel available. Although there were only 23,000 personnel assigned to this branch at the start of World War II, a rapid four-fold expansion occurred in 1940–41. When the Wehrmacht invaded the Soviet Union in June 1941, the three army groups involved included about 95,000 Panzerjäger. Most Panzerjäger units were at or near full strength and contained a large proportion of veterans from previous campaigns.

Like most of the other German branches of service, Panzerjäger personnel were primarily recruited and trained in their *Wehrkreis* (military district) of origin. There were a total of 15 Panzerjäger-Ersatz-Abteilung in September 1939, one for each *Wehrkreis*, and these training units supplied Panzerjäger replacements to all the divisions originating in their district. New recruits spent 12–16 weeks in basic training at the replacement battalion (training times were reduced after Stalingrad), receiving a heavy dose of infantry field training since the Panzerjäger were expected to operate up front with the infantry. Toward the end of their basic training, recruits were formed into gun crews under an experienced Unteroffizier and drilled on 3.7cm PaK guns, which were perfect for instruction. In March 1940, a training company for crews for the Panzerjäger I was established at the Panzer school at Wünsdorf and later, crews for *Marder*-series vehicles were trained there as well.

The standard towed Panzerjäger crew consisted of an NCO gun commander, an Obergefreiter as gun layer, a loader, two ammunition handlers and the driver for their prime mover. Crews were drilled until they could achieve a high rate of fire in dry runs, then shifted to local firing ranges for live fire. Trainees were taught to estimate ranges quickly and accurately and to engage a mix of moving and stationary targets. After June 1941, Panzerjäger recruits were given the opportunity to practice their gunnery skills upon captured Soviet tank hulks, including a few KV-1 and KV-2 heavy

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The Waffen-SS units had their own Panzerjäger units. Here, a 3.7cm PaK crew defends a road intersection. The use of local camouflage to break up the outline of the gun was emphasized in training, but deploying the weapon in the middle of the road seriously reduced this crew's life expectancy. (Ian Barter)

tanks. Panzerjäger training emphasized selecting firing positions with good fields of fire and then camouflaging their weapon, be it towed or self-propelled, so that it had a high probability of getting the first shot in during an anti-armor engagement. With the standard 3.7cm and 5cm PaK weapons, crews were trained not to engage targets beyond 600m since the probability of penetration against most enemy tanks was remote. Instead, Panzerjäger training emphasized using their concealed position to wait for enemy heavy tanks to pass obliquely to their PaK position, then to pour a fusillade of armor-piercing shells into the thinner side armor of the target. This tactic worked to some extent against the French Char B1 *bis* heavy tank in the 1940 Western campaign.

A German Panzerjäger crew firing a 7.5cm PaK 40 against Soviet tank hulks on a firing range. German training was normally regarded as tough and realistic, although it should be evident that here the loader is standing at full height and the gun commander is casually sitting on the towing hitch, neither posture being likely in combat. (Ian Barter)

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Once trained, a gun crew was sent in a recruit draft to join an antitank unit at the army, division or regimental level. Each German infantry and Panzer division had a Panzerjäger-Abteilung, with a typical authorized strength of around 700 men, organized in a headquarters, three Panzerjäger companies, an antiaircraft company (with 12 2cm Flak), and battalion logistic trains. At the start of Operation *Barbarossa*, the battalions were completely motorized and authorized about 110 vehicles, although there was little standardization and many Panzerjäger units relied upon captured British and French trucks that did not last long in the harsh Russian environment. For example, the 14./Infanterie-Regiment 437 in the 6.Armee had ten French UE *Chenillette* tractors to pull its PaK guns, but eight of them broke down in the first three months of the campaign. By 1942, horses were being used as substitutes to pull PaK guns in some units. In 1941, a standard German Panzerjäger-Kompanie had three platoons with three 3.7cm PaK each and one platoon with two 5cm PaK 40. The company had a total authorized strength of 159 men and 34 vehicles, with the Krupp *Protze* being the preferred prime mover. Tactically, the Panzerjäger-Abteilung was employed in a "fire brigade" manner to back up hard-pressed infantry regiments whenever substantial amounts of enemy armor appeared, with each company operating semi-independently. Regimental-level Panzerjäger companies provided the first layer of local antitank defense, but were stuck with the 3.7cm PaK for most of the war, while the divisional antitank units were continually upgraded with new and better PaK weapons.

A 5cm PaK 38 crew in a more realistic training posture, with the crew hunched behind the gun shield. Note the battery observer's telescope to the right. The low profile made the PaK 38 very difficult for KV-1 tanks to spot. (Ian Barter)

All of the self-propelled antitank guns were initially operated by army-level Panzerjäger-Abteilung, each provided with three companies totaling 27 self-propelled guns. Personnel assigned to these units received the same training as their towed counterparts, although with additional training on their respective vehicles. Given the size of their vehicles, the self-propelled Panzerjäger could not rely as much on camouflage and flank shots and had to develop more mobile "shoot and scoot" tactics that gave their thinly protected vehicles a chance to survive encounters with their better-armored opponents.

At the start of Operation *Barbarossa*, about one-third of the German Panzerjäger had prior combat experience against enemy tanks, primarily in the French campaign. Small-unit leadership was usually very good, although some NCOs and platoon leaders lacked sufficient aggressiveness and viewed their mission as essentially defensive. Morale was high among the Panzerjäger at the start of the campaign, but early encounters with the KV-1 and T-34 shattered their confidence in the 3.7cm and 5cm PaK guns. Thereafter, the Panzerjäger felt overmatched by enemy heavy tanks and this attitude persisted until better 7.5cm weapons began arriving in quantity in mid-1942.

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COMBAT

Nobody in Germany knew anything about these [KV heavy] tanks, even that they were under construction.
Major Joachim von Kielmansegg, Chief of Staff 6.Panzer-Division, June 1941

BORDER BATTLES, JUNE–JULY 1941

As expected, the Panzerjäger made short work of the handful of T-35 heavy tanks, most of which broke down before they even met the enemy. (Author)

The Northwest Front had two mechanized corps available to counterattack *Heeresgruppe Nord*'s invasion of the Baltic States on June 22, 1941, but only two battalions of KV-1 and KV-2 tanks in the 2nd Tank Division. At 1730 hours on June 22, the 2nd Tank Division was ordered to advance westward toward Raseiniai, as part of a larger counterattack against the German spearhead, Panzergruppe 1. After an approach march of over 100km (62mi) along dusty side roads, the division approached Raseiniai from the east on the evening of June 23. However, the KVs had suffered badly on the road march from clogged air filters and balky transmissions, with most of the KV-2s and about ten of the KV-1s falling out along the way. On the positive side, the German

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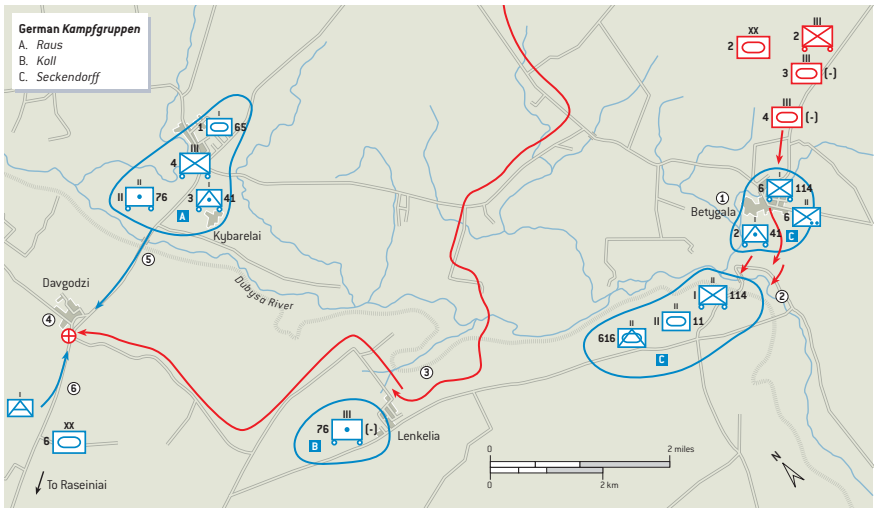

The battle of Raseiniai, June 24, 1941

The Soviet 2nd Tank Division attacked *Kampfgruppe Seckendorff*'s bridgehead over the Dubysa River at sunrise, with BT and T-26 light tanks of the 4th Tank Regiment in the lead, followed by a mixed battalion of KV-1 and KV-2 tanks of the 3rd Tank Regiment (**1**). By 0900 hours, the German units were overrun and forced to retreat across the river. Some Soviet tanks and infantry advanced across the river around 1200 hours and engaged the rest of *Kampfgruppe Seckendorff*, which was hard-pressed (**2**). A small group of Soviet tanks, including three KVs, crossed the Dubysa at an unguarded point and headed toward Raseiniai. However, two were immobilized by German heavy artillery firing in direct lay (**3**). A single KV-2 bypassed *Kampfgruppe Koll* and managed to reach the road supplying *Kampfgruppe Raus* before running out of fuel (**4**). *Kampfgruppe Raus* attacked the stranded KV-2 with 5cm PaK and engineers, but failed to destroy it (**5**). A two-gun battery of 8.8cm Flak arrived at dusk (**6**) and engaged the KV-2 at first light the next day.

6. Panzer-Division was caught spread out after capturing Raseiniai, with *Kampfgruppe Raus* and *Kampfgruppe Seckendorff* having thrown bridgeheads across the nearby Dubysa River. The 2nd Tank Division concentrated all available armor, including 21 KV-1s and a few KV-2s, against *Seckendorff*'s bridgehead.

The Soviet attack began just after dawn on June 24. *Kampfgruppe Seckendorff* had the Kradschützen-Abteilung 6 and the 2.Kompanie of Panzerjäger-Abteilung 41 in its bridgehead, with 12 3.7cm PaK and four 5cm PaK. The Panzerjäger were stunned by the appearance of the huge enemy tanks approaching, but waited until they were within 200m before opening fire. However, they were even more shocked when the standard armor-piercing rounds bounced off the thick frontal armor of the KVs, with no effect. Despite the fire of all weapons, including artillery, the KV-1 tanks managed to overrun most of the German motorcycle troops and their accompanying PaK unit – the first time during World War II that German infantry had been overrun by enemy tanks. Many of the surviving German troops were so terrified that they simply hid, although one Leutnant immobilized a KV-1 with Teller mines. Even worse, a number of KV-1 and KV-2 tanks got across the Dubysa River with some Soviet infantry and smashed into Schützen-Regiment 114 (mot.) and overran some of the divisional artillery. A KV-1 platoon led by Major Dmitri I. Osadchy pushed toward Raseiniai:

> The column [of the 1st Platoon], consisting of four tanks moved in the direction where the recent fighting was. Examining the next grove of trees, we came upon the enemy's artillery firing positions. Advancing from the flank, we poured fire from the machine guns and the enemy gunners began to panic. When we hit the fourth artillery piece something unexpected happened: my tank was off the ground and hanging on it. The driver, Sergeant Andrei Yasnyuk, worked hard to shake the tank, and move it. Finally, after crushing the cannon, the tank treads touched solid ground again. Once the artillery firing positions were eliminated, we moved into a clearing to return to the starting area.

After hours of the KV-1 tanks running rampage on *Kampfgruppe Seckendorff* the Germans were able to get a few 15cm howitzers and 8.8cm Flak guns into action,

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A 3.7cm PaK crushed flat by a KV heavy tank. German troops had almost no experience of being overrun by enemy tanks and were horrified to see their PaK guns crushed underneath the Soviet KVs' tracks – exactly the psychological effect that Stalin had intended. (Author)

which succeeded in immobilizing some of the Soviet heavy tanks. One KV required 13 hits from an 8.8cm Flak before it was stopped. Major Ivan Ragochy, commander of the 3rd Tank Regiment, was killed by splinters when a heavy shell hit the side of his KV-1's turret; the round did not penetrate but caused spalling on the interior. By late afternoon the Soviet tanks were running out of fuel and ammunition and those still capable of moving retired back across the Dubysa River. A lone KV-2 that managed to bypass the German artillery pressed on toward Raseiniai and managed to infiltrate behind *Kampfgruppe Raus* before it, too, ran out of fuel.

The actions of *Kampfgruppe Raus* against this single KV-2, probably commanded by Leytenant Vladimir A. Smirnov, are well known. Beginning at 1200 hours on June 24, this KV-2 defied all efforts to neutralize it for more than a day and succeeded in interdicting *Kampfgruppe Raus*' supply lines. Initially, a platoon of 5cm PaK 38 guns under Leutnant Wengenroth from the 3./Panzerjäger-Abteilung 41 was able to quietly maneuver within about 200–400m of the immobilized KV-2 – demonstrating the mobility of the weapon – before scoring eight direct hits on the turret and hull. Wengenroth's gunners had some PzGr 40 rounds, but even these had no effect. In response, the KV-2 accurately fired back with several 152mm high-explosive rounds, which destroyed two 5cm PaK 38 guns and disabled the other two. The Panzerjäger were shocked that their newest weapon, the 5cm PaK 38, was totally ineffective. *Kampfgruppe Raus* then tried to maneuver an 8.8cm Flak gun into position but before it could fire, the alert KV-2 crew spotted it and knocked it out as well. Finally, the KV-2 was knocked out the next day when another 8.8cm Flak gun was brought up and managed to fire seven armor-piercing rounds into the rear of the tank from 800m. By this point, the German XXXXI Armeekorps (mot.) had swung the 1.Panzer-Division behind the right flank of the 2nd Tank Division near Saukotas, in an effort to encircle the Soviet armored group. On June 25, the remaining KV heavy tanks tried to break through the German envelopment and overrun the II./Schützen-Regiment 1. Frantic, *Kampfgruppe Westhoven* reported that: "Neither the infantry's antitank guns nor those of our own Panzerjäger platoons (six 5cm PaK) … are able to pierce

The appearance of the KV-2 on the battlefield was one of the greatest technical shocks that the Wehrmacht experienced in World War II. The fact that the Red Army – regarded as technically backward – had deployed a tank that was virtually invulnerable to all German PaK weapons was unnerving. (Ian Barter)

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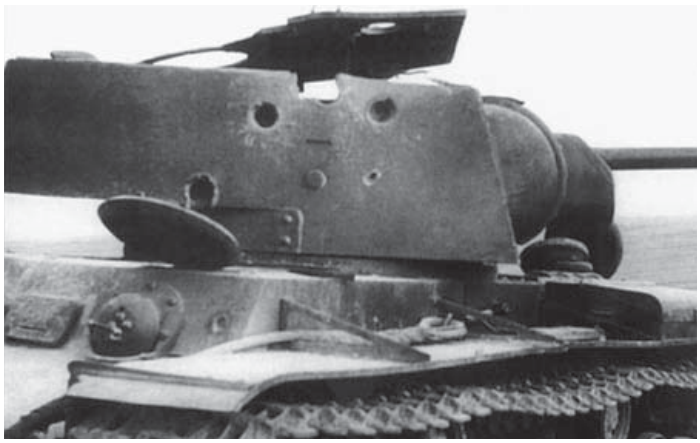
the plating of the heavy Russian tanks. What can be done to stop those heavy Russian tanks?"[6]

Once again, the 1.Panzer-Division was able to get a few 8.8cm Flak guns and a battery of 10.5cm howitzers into the fight, and these were able to immobilize some KVs. The battle of Raseiniai ended with the 2nd Tank Division surrounded and 29 of the KV heavy tanks belonging to the Northwest Front lost, but the Panzerjäger had failed in their primary mission and allowed both friendly infantry and artillery to be overrun. Furthermore, many of the Soviet tankers survived the battle and retreated northward, where they would soon receive new tanks. On June 27, a special commission from the OKH arrived in *Heeresgruppe Nord* to investigate these first encounters with the KV heavy tanks; as soon as they returned to Berlin, the Heereswaffenamt was directed to award contracts to Krupp and Rheinmetall immediately to deliver 7.5cm PaK guns as soon as possible.



A KV-1 destroyed by three 8.8cm armor-piercing rounds which struck the turret, penetrated and detonated the ammunition inside, blowing out the roof. The 8.8cm Flak 18 antiaircraft gun could defeat the KV-1 but was poorly suited to frontline antitank combat due to its size and weight. (Author)

In the Western Military District, a total of 112 KV heavy tanks were concentrated in the 4th and 7th Tank Divisions of the 6th Mechanized Corps stationed near Bialystok. However, the four KV battalions in this corps were handicapped by severe shortages of fuel and ammunition; most had only a single load of fuel and many had no 76.2mm ammunition at all. Nevertheless, when the German invasion began, the 6th Mechanized Corps was ordered to concentrate its armor and launch a counterattack toward Grodno. Instead, the 140km (87mi) approach march merely consumed the limited fuel available and caused more than a dozen KVs to drop out with transmission defects. In spite of this, the 6th Mechanized Corps attacked the 256.Infanterie-Division on June 24–25 and the remaining KVs went into action. A German war correspondent was present and witnessed the fight between the KVs and Panzerjäger-Abteilung 256:

> And then the cannon barrels rise above the horizon, a high turret becomes visible, a gigantic tank body. Tanks! Giant tanks such as we have never yet seen! Russian 52-ton tanks with 15 cm guns! Crippling fear strikes us. Then the PaK guns are turned around, our fire bursts from all their barrels, but the light armor-piercing weapons can do nothing here. The shots bounce off the mighty steel walls like rubber balls … The Panzerjäger fight with wild intensity. They let it come to the shortest ranges, firing cold-bloodedly, as they have learned, at its weakest points.[7]

Although many PaK guns were destroyed at little cost to the KVs, the heavy tank battalions could not accomplish their breakthrough mission without adequate fuel

6 A. D. von Plato, "1st Panzer Division Operations," in David Glantz (ed.), *The Initial Period of War on the Eastern Front*, London: Frank Cass, 1993, p. 145.

7 Horst Slesina, *Soldaten gegen Tod und Teufel*, Düsseldorf, 1942.

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RUDOLF BITTNER (1921–45)

Born in Sachsenhausen, just north of Berlin, in 1921, Rudolf Bittner was the son of a plumber. After a stint in the Reich Labor Service (RAD), the 17-year-old Bittner joined the Wehrmacht in late August 1939 and trained at the PanzerAbwehr-Ersatz-Abteilung 3 in Potsdam. By Christmas 1939, Bittner was assigned to the 2./Panzerjäger-Abteilung 561, an army-level antitank unit equipped with 3.7cm PaK guns. During the 1940 campaign in the West, Bittner was involved in operations against the Maginot Line but saw no significant action against French tanks.

The *Marder* II Ausf C with 7.5cm PaK 40 was the best self-propelled Panzerjäger weapon available during the winter of 1942/43. Almost 300 of these excellent weapons were built by the end of 1942. (Ian Barter)

Rudolf Bittner (1921–45). (Author)

After the French campaign, Bittner was promoted to Obergefreiter and made a gunner in the 2.Kompanie, while his battalion was reequipped with Panzerjäger I self-propelled 4.7cm guns. At the outset of Operation *Barbarossa*, Bittner's unit supported the 9.Armee and he was involved in his first antitank duels. Bittner fought in the bitter defensive battles around the Rzhev salient throughout the winter of 1941/42. In May 1942, his battalion received 12 of the new 7.5cm PaK 41 guns and Bittner was assigned to one as a gunner. In early August, the Soviet Western Front began a major offensive pushing toward Rzhev and Bittner's company was sent to defend the town of Zubstov. Zhukov committed the 6th and 8th Tank Corps, which had over 300 tanks including 48 KV-1s, to take this town on August 6. Equipped with the best antitank gun on the planet and adequate tungsten-core rounds, Bittner knocked out seven KV-1s. Although Zubstov eventually fell, the German Panzerjäger defense knocked out nearly 50 percent of the Soviet armor in a three-day duel. Soviet attacks continued to hammer away against the Rzhev salient and on September 9, a group of five KV-1s threatened another sector. On his own initiative, Bittner repositioned his PaK and engaged the KV-1s, destroying four of them and damaging the fifth. For his prowess against Soviet heavy tanks, Bittner was awarded the Ritterkreuz (Knight's Cross) and promoted to Unteroffizier in November 1942.

Due to the reliance of the PaK 41 on scarce tungsten-core rounds, this weapon was withdrawn from service in mid-1943 and Bittner's unit was reequipped with *Marder* IIs. Bittner was made a platoon leader and spent the next two years trying to slow the advance of Soviet armor westward. In January 1945, while his unit was retreating in Upper Silesia, Bittner went missing in action.

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PAVEL GUDZ (1919–2008)

Pavel Gudz was born into a peasant family in the Ukrainian Kamyanets–Podilskiy region. Although his father died when he was young, Pavel was a talented youth and managed to not only complete high school but then attend a technical college. He joined the Communist Party and then volunteered for service in the Red Army.

In August 1939, the 20-year-old Pavel Gudz entered the Saratov Heavy Tank School, where he spent the next 22 months training first on the T-35 and then the KV-1. He graduated in early June 1941 and was posted as a platoon leader to the 1st Battalion/63rd Tank Regiment in the 4th Mechanized Corps in the Kiev Military District. Gudz was fortunate that his battalion missed the disastrous battle of Dubno, where so many KVs were lost, but he was involved in the delaying actions fought south of Kiev in July 1941. He also missed encirclement in the Kiev Pocket. His battalion was dissolved in August and Gudz was sent to Moscow with other survivors to form one of the new heavy tank units. Leytenant Gudz was assigned to the 89th Separate Tank Battalion, which, after participating in the parade in Moscow on November 7, was sent to reinforce Rokossovsky's 16th Army near Volokolamsk. Gudz's battalion played a major role in halting the German advance toward Moscow, but in the process it lost all but two KV-1 tanks in a month of combat. When the Soviet winter counteroffensive began on December 5, Gudz commanded one of the two remaining KV-1 tanks and conducted a single-tank attack upon a German-held village. During a three-hour fight, Gudz's KV-1 was hit 29 times but not penetrated, while he managed to knock out four PaK guns. In recognition of his success, Gudz was awarded the Order of Lenin and was soon promoted to Kapitan and deputy commander of the 89th Separate Tank Battalion. Over the next six months, Gudz was involved in numerous actions around Vyazma against German PaK guns.

In July 1942, Kapitan Gudz was assigned to command the 574th Tank Battalion in the 212th Tank Brigade belonging to the Don Front. By November, he was promoted to Major and commanded the 8th Guards Heavy Tank Regiment during Operation *Uranus*. However, Gudz was badly wounded during the subsequent reduction of the Stalingrad pocket and he did not return to action until May 1943, when he became deputy commander of the 5th Guards Heavy Tank Regiment. During the advance across the Ukraine after the battle of Kursk, Gudz was promoted to Podpolkovnik, but lost an arm when his tank was destroyed at Zaporozhe. Gudz managed to return to his regiment briefly, just as it was converting to IS-1 (IS-85) heavy tanks in April 1944, but his health was fragile so he was sent to join the staff at the Military Academy of Armored Forces in Moscow.

Pavel Gudz (1919–2008). (Author)

After World War II, Gudz spent the next 40 years at the Military Academy of Armored Forces and thrived in the academic arena. He completed his scientific education and then played a major role in shaping post-war Soviet armored doctrine, including participation in the development of the BMP infantry fighting vehicle. Gudz also became a specialist in nuclear weapons and participated in the Red Army's first major above-ground nuclear tests in 1954. When he retired in 1989 after 50 years of service, Gudz had risen to be Colonel-General of Armored Forces and an honored Soviet scientist. Gudz died in Moscow in May 2008.

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German troops examine a KV-1 that lost its turret after a catastrophic explosion. It was rare that the Germans could inflict this kind of damage on a KV-1 in 1941 and this tank might have been destroyed by its own crew after running out of fuel. (Ian Barter)

and ammunition. Eventually, all of the Western Front KVs were lost within a week of the beginning of the war, primarily due to fuel shortages and mechanical defects. In response, the *Stavka* directed on June 30 that 44 brand-new KVs from the Kirov plant be sent directly to the Western Front to reequip the 7th Mechanized Corps for a counterattack. But the untrained drivers burned out the clutches on seven KVs moving just 5km (3mi) from the railhead to an assembly area. When the 7th Mechanized Corps launched a counterattack near Polotsk on July 7, it lost seven KVs in a swamp and all but one KV-2 was out of action within two weeks. This Soviet counterattack was a fiasco and squandered most of the Western Front's remaining KVs.

It was in the south that the Germans would face the greatest threat from KV heavy tanks, since the Kiev Military District had over 260 KVs within the 4th, 8th, 15th and 22nd Mechanized Corps. Although the Southwest Front attempted to mass these corps into an armored fist to counterattack the spearheads of Panzergruppe 1 between Brody and Dubno on June 23–28, due to poor command and control they ended up fighting a piecemeal battle. A number of KVs were lost due to transmission and brake failures, and poor map-reading resulted in several KVs being lost in the marshy terrain around Dubno. Consequently, only about 120 KVs from the 8th and 15th Mechanized Corps were able to strike the flank of Panzergruppe 1 north of Brody on June 26. The 1st Battalion/24th Tank Regiment enjoyed particular success by overrunning part of the 57.Infanterie-Division in Leshnev, including a Panzerjäger unit. Some KVs were hit over 100 times by 3.7cm and 5cm fire without a single penetration. Both the commander of the 8th Mechanized Corps, General Rybayshev, and of the 12th Tank Division, General Mishanin, decided to use KV-1 tanks as their command vehicles in this attack, but the KVs proved unsuited for this role since they tended to attract fire. Mishanin was seriously wounded when an air attack caught his KV in the streets of Brody. For about 24 hours, the Soviet advance made good progress and appeared poised to encircle the 11. and 16.Panzer-Divisionen. When the German Panzerjäger failed to stop the KVs, 8.8cm Flak guns and heavy howitzers were employed, but even these weapons could not always penetrate the KV's armor. Kapitan Zinoviev K. Slyusarenko, commander of the 1st Battalion/19th Tank Regiment, noted that: "The enemy shells could not penetrate our armor, but damaged treads, knocked off turrets. KV tanks were powerful vehicles, but sorely lacking in speed and maneuverability."

However, Panzergruppe 1 displayed considerable flexibility by shifting the 75. Infanterie-Division to block the path of the advancing 8th Mechanized Corps, while sending the 16.Panzer-Division against the flanks of the Soviet penetration. After several days of combat, the KVs were running short of fuel and ammunition and were barely aware that they were being enveloped. By late on June 28, the bulk of the 8th Mechanized Corps was itself encircled and the Soviet counteroffensive fell apart. By the end of the battle of Brody, only about 20 out of 120 KV tanks from the 8th

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and 15th Mechanized Corps were still operational. Less than 25 percent of the losses had been due to enemy action; the rest due to mechanical defects and fuel shortages. Since repair units and spare parts for the KVs were non-existent, even minor problems caused tanks to be abandoned. After the counterattacks at Brody and Dubno, all but 13 KVs were lost in retreats and played a negligible role in combat around Kiev.

DEFENDING THE APPROACHES TO LENINGRAD AND MOSCOW, JULY–DECEMBER 1941

Despite their enormous advantage over German Panzerjäger capabilities, the bulk of the pre-war KV force was eliminated within six weeks of the German invasion. Thereafter, only small numbers of KVs were left in the field, while new units were being formed in Leningrad. However, since the Kirov plant built just 414 KVs in July–September 1941, the Red Army received only a trickle of heavy tanks when they needed them most. With KV production centered in Leningrad, it was relatively straightforward for the Northwest Front to form several independent companies of 7–10 KVs each and dispatch them to augment local counterattacks. The Northwest Front was able to gather 250 tanks from the 1st Mechanized Corps, including ten KV-1 tanks, to strike the German XXXXI Armeekorps (mot.) at Ostrov on July 5.

Tank panic! Soviet KV heavy tanks counterattack on the Pulkovo Heights, September 13, 1941 (overleaf)
As the German Panzer spearheads closed in on Leningrad from the south and southwest, Zhukov used his remaining KV heavy tanks to launch a series of sudden counterattacks against the German forces closing in on Leningrad from the south and southwest. Since the most dangerous threat was posed by the German XXXXI Armeekorps (mot.), which had reached the Pulkovo Heights overlooking Leningrad, the Red Army massed three KV-1 and five KV-2 tanks, 15 light tanks and a battalion of infantry against a *Kampfgruppe* from the 36.Infanterie-Division (mot.).

The German infantry from the I./Schützen-Regiment 118 had just established combat outposts on Hill 66 near the Pulkovo Observatory, when the Soviet heavy tanks appeared coming up the slopes. Moving in wedge formation, the KVs overran some of the regimental-level 3.7cm PaK guns, whose shells merely bounced off the KVs' thick armor. The German PaK guns were crushed under the tracks of the KV-1s, their crews killed, and their prime movers blown to pieces by HE-FRAG rounds. Seeing their regimental Panzerjäger annihilated, the German infantry momentarily panicked and the I./Schützen-Regiment 118 fell back in some disorder.

Elements of the division-level Panzerjäger-Abteilung 36 arrived and began to engage the KVs at close range. Here, a PaK 38 hits the frontal armor of a KV-1 at under 100m, which sends up a shower of sparks, but causes no serious damage. After losing several 5cm guns and their prime movers, the German division commander granted permission to use the limited number of PzGr 40 "arrowhead" tungsten-core rounds. Eventually, two KV-2s and one KV-1 were immobilized, which caused the Soviet attack to falter. However, the realization that more KV heavy tanks awaited them inside Leningrad helped to dampen the enthusiasm of *Heeresgruppe Nord*'s soldiers to fight their way into the Soviet city. Thus, the inability of the Panzerjäger to attack and defeat large numbers of dug-in KVs was a contributing factor to the German failure to seize Leningrad in 1941.

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KV-1 tanks from the 1st Tank Division maneuver into hull-down ambush positions south of Leningrad, August 1941. When operated by experienced reservist crews, the KV-1 proved to be an excellent defensive tank. (Author)

Around 1400 hours, *Kampfgruppe Krüger* of the 1. Panzer-Division was attacked by a mixed company of KV-1 and KV-2 tanks, which overwhelmed the 3.7cm PaK of the 1./Panzerjäger-Abteilung 37. A number of 3.7cm PaK guns were crushed under the KVs and the attack was not stopped until direct fire from the 10.5cm howitzers of the III./Artillerie-Regiment 73 immobilized two KVs. However, the Soviet counterattack at Ostrov failed to stop the German advance on Leningrad. Ten days later, the Northwest Front committed 150 tanks (including two KV-1 tanks) against von Manstein's LVI Armeekorps (mot.) at Soltsy on July 15, 1941. Another counteroffensive at Staraya Russa in August involved company-size units of KVs. During July–August, the few KVs at the front were severely handicapped by fuel and ammunition shortages, particularly the OF-350 HE-FRAG rounds best suited to engage German Panzerjäger.

Many of the reservists who had served in the 20th Heavy Tank Brigade in the Russo-Finnish War were called up immediately once the war began and sent to Leningrad to receive new KV tanks at the Kirov plant. One such reservist was Leytenant Zinovy Kolobanov, who had seen considerable action in a T-28 medium tank against the Mannerheim Line. In early August, Kolobanov was put in command of a company of brand-new KV-1 tanks, equipped with extra bolt-on armor, and assigned to the 1st Tank Division. As *Heeresgruppe Nord* lunged northward, the Red Army was able to establish a fortified position at Krasnogvardeisk, only 40km (25mi) from Leningrad. Kolobanov's KV-1 company was sent to Krasnogvardeisk and he deployed his three KV platoons to cover the likely enemy avenues of approach. On the morning of August 19, Kolobanov spotted the advance guard of the 8.Panzer-Division advancing in column and he initiated the ambush at a range of 450m. In quick succession, Kolobanov knocked out the lead vehicles in the column, but German Panzerjäger were quick to unlimber several PaK guns and deploy them on the road. At a distance of 450m, the PaK guns could not hope to penetrate the thick frontal armor of Kolobanov's KV-1, but they poured a barrage of fire at the stationary heavy tank, which was hit a total of 156 times. Although the KV-1 was not penetrated, the panoramic sight was demolished and the turret was jammed by multiple concussions. Kolobanov's gunner, Sergeant Andrei Usov, fired off the entire basic load of 98 rounds at the German column and then Kolobanov broke off the action and withdrew to rejoin the rest of his company. While the KV had not demonstrated the mechanical reliability to perform well in its intended role as a breakthrough tank, it proved to be very well suited as a defensive tank.

Despite the successful ambush at Krasnogvardeisk, *Heeresgruppe Nord* continued to make good progress toward Leningrad and were at the gates of the city by early September. Most of the remaining KV tanks produced at the Kirov plant in August–September were earmarked for the defense of Leningrad and the Germans started to notice increasing numbers of "52-ton tanks" as they drew closer to the city. A breakthrough by the XXXXI Armeekorps (mot.) reached the Pulkovo Heights just south of the city, which prompted the defenders to launch a battalion-sized

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counterattack supported by eight KV tanks on September 13. The duel between the KVs and Panzerjäger-Abteilung 36 went badly for the Germans, forcing *Heeresgruppe Nord* to reconsider a direct attack into the city. The 3.7cm and 5cm PaK guns could not defeat multiple KVs, particularly when the tanks were supported by infantry and artillery, and it was impractical to try to bring heavy artillery up to the frontline to engage them. The counterattacks on the Pulkovo Heights bought precious time to evacuate the Kirov plant to Chelyabinsk before Leningrad was encircled; and to organize a defense of the city. Afterwards, two heavy tank brigades, the 122nd and the 124th, were formed with over 60 KVs – the largest concentration of Soviet heavy tanks in the fall of 1941.

Despite the rarity of KVs after the defeats on the border, in sectors where they did appear, the Panzerjäger usually faced a one-sided duel. Standard Panzerjäger tactics of engaging attacking enemy armor at distances of 200–400m simply did not work against KVs. The only tactic that appeared to offer any hope was to let attacking KVs pass by a concealed PaK, then engage it from the rear – assuming that it had no infantry support. If rounds could be made to ricochet into the 30mm belly armor, the 3.7cm PzGr (*Panzergranate*) rounds might inflict impact damage on the engine or final drive. Amazingly, Gefreiter Wilhelm Brückner, a regimental PaK gunner in the 14./Infanterie-Regiment 253, managed to accomplish this feat on September 3 near Bryansk, immobilizing two KVs with lucky hits from his 3.7cm gun. A week later, he repeated this by immobilizing two more KVs – which attacked individually and without infantry support – with a fusillade of 3.7cm rounds poured into the rear of the passing tanks at point-blank range. In each case, Brückner's rounds failed to penetrate the KV's armor, but caused enough damage that the tank was immobilized. However, in each case the crew remained with the tank and continued to operate its weapons, the tanks essentially becoming bunkers. Brückner was awarded the Ritterkreuz, but his phenomenal luck ran out two months later and he was killed in action during Operation *Typhoon*.

When German forces began their final advance against Moscow in October 1941, the number of KVs available to defend the Soviet capital was still only a tiny fraction of the Red Army's remaining tank strength. On October 1, 1941, the Western Front had 19 KVs and the Bryansk Front had 22 KVs, out of a total of 700 tanks deployed on the Moscow axis. Throughout the fighting around Moscow in October–November, the Red Army never had more than 33 KVs available at any one time and often only half that number. By this point, KVs were usually grouped in platoon-size units and attached to independent tank battalions or brigades, which diluted their influence on the battle. On October 13, a small number of KVs counterattacked the German 34 Infanterie-Division, causing considerable alarm. Günther von Kluge, commander of the 4.Armee, reported that: "these tanks absorbed a lot of armor-piercing shells and projectiles up to 10.5cm." Three 10.5cm howitzers were lost trying to stop the KV attack and Panzerjäger-Abteilung 34 lost one 3.7cm and seven 5cm PaK guns. Kluge commented that: "despite the numerous hits of armor-piercing projectiles, including on the turret, we could not penetrate the enemy tanks. In the event of an attack by a large number of such tanks, we could suffer a local defeat."

The first Chelyabinsk-built KV-1 tanks, equipped with the ZIS-5 gun, were sent to Moscow in November 1941, but most were used as semi-stationary strongpoints.

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The Germans were forced to rely almost completely upon the 3.7cm PaK during the desperate winter battles of 1941/42, since the 5cm PaK proved less reliable in extreme cold weather and the 7.5cm PaK were not yet available. (Ian Barter)

Indeed, the KVs proved to be an excellent defensive weapon, when properly led and supplied. In September, the 4th Tank Brigade formed at Stalingrad under Polkovnik Mikhail Katukov, one of the most capable Soviet tank tacticians. While most of the new tank brigades were formed from odds and ends, the Stavka intended that the 4th Tank Brigade would be fully outfitted with the best equipment, which included a company of ten KV-1 tanks, a T-34 battalion and a BT-7 battalion. Katukov's brigade was husbanded in reserve near Moscow as a mobile counterattack reserve and when Panzergruppe Guderian stormed into Orel in early October, the brigade was deployed as a blocking force near Mtensk. Katukov was able to ambush the 4.Panzer-Division near Mtensk on October 6 and inflict painful losses on Guderian's spearhead. Although the Germans had faced both KVs and T-34s before, the battle of Mtensk was a very different experience; this time the Soviet tankers had adequate fuel and ammunition, as well as a commander who knew how to use them. *Kampfgruppe Eberbach* faced a well-planned counterattack by both KVs and T-34s, which the attached Panzerjäger from Panzerjäger-Abteilung 49 were helpless to stop. Eberbach had made some provision for the appearance of Soviet heavy tanks by attaching two 8.8cm Flak guns and a battery of heavy howitzers to his *Kampfgruppe*, which were pressed into service as antitank guns to stop Katukov's tanks. While these guns did knock out a number of KVs and T-34s, their height made them easy to identify and the Soviet tankers destroyed both 8.8cm Flak guns and one of the howitzers, thus illustrating the inherent risk of using antitank substitutes.

By the end of 1941, KVs had virtually vanished from the battlefield, except on the Leningrad and Volkhov Fronts. On the Volkhov Front, KVs from the 122nd and 124th Heavy Tank Brigades would assemble in the open within full view of German positions 600–800m away and then begin shelling anything that moved, which unnerved the German infantry who lacked an effective means to reply. Soviet troops dubbed the KVs "White Mammoths" and appreciated their ability to intimidate the Germans. Indeed, German morale was seriously undermined by the brute strength of the KV tank, and a program was under way in Germany to get better antitank weapons to the front as soon as possible. On each occasion on which KVs had appeared on the battlefield, the Panzerjäger had proved virtually impotent and local commanders had been forced to use Flak guns and heavy artillery as substitutes. Even when equipped with PzGr 40 rounds, 5cm PaK gunners were often forced to engage KV tanks at ranges of just 20–30m, firing wildly before they were crushed under the tracks. Meanwhile, Kotin's team at Chelyabinsk struggled to ramp up KV-1 production. Further production of the KV-2 was canceled due to its poor mechanical reliability; but despite some critical reports from Soviet tankers about the KVs'

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problematic transmission and brakes, the Stavka believed that the KV-1 could still be a decisive weapon if they could mass enough of them at the right time. As 1941 ended, the Germans were frantically trying to get new PaK guns to the front, while the Soviets were preparing to deliver large numbers of KV-1 tanks to rebuild their depleted tank units.

BY ANY MEANS NECESSARY, SPRING 1942

The impotence of Panzerjäger units against Soviet heavy tanks in the first year of the war in the East forced infantry units to develop expedient combat methods, including flaming fuel, blinding the sights on KVs with mud, and efforts to damage the track or jam the turret. These tactics of desperation resulted in the creation of the Panzer Destruction Badge in early 1942 and the sobriquet of *Panzerknacker* (tank breaker), for which Panzerjäger were not eligible.

Too few KVs were available to play a decisive role in the winter counteroffensive, but even small numbers were able to strike great fear into German troops when they appeared. A typical combat action occurred near the village of Klepenino northwest of Rzhev, when a single KV-1 appeared around 0500 hours on February 5, 1942, and began to shell buildings occupied by German troops. It took over three hours for Leutnant Höfer from Panzerjäger-Abteilung 256 to maneuver a single 5cm PaK through the deep snow and get it into a firing position on the flank of the KV-1. Firing from a range of 150m, the 5cm gun hit the KV-1 26 times but ran out of ammunition without destroying the tank. With its armor plate cracked in many places, the KV-1, its own ammunition exhausted, waddled back to Soviet lines. Despite incidents such as this, the first signs were beginning to appear that the KV's days of operating with impunity on the battlefield were numbered. A small quantity of 7.5cm HEAT rounds reached *Heeresgruppe Nord* in mid-January 1942 and four KV-1 tanks were knocked out on the Volkhov Front at ranges heretofore considered impossible. Soviet KV crews had become accustomed to moving with impunity in full view of German positions, but this unpleasant experience made them more cautious.

In March 1942, the OKH conducted firing trials on captured KV-1 tanks at Rzhev. Firing tungsten-core PzGr 40 tungsten-core rounds at a range of 60m, the 5cm PaK 38 achieved successful penetrations on only five out of ten shots. The 2.8cm sPzB 41 was able to penetrate KV-1 turret armor from a range of 60m in five of 15 shots. The OKH ordnance officers were also eager to see the effects of the new 3.7cm *Stielgranate* 41 against the KV-1 and gleefully reported that: "Each direct hit with the *Stielgranate* 41 causes the

After the first winter in Russia, the Germans no longer had sufficient wheeled vehicles left to keep all their Panzerjäger units motorized. Increasingly, units were forced to use horses to move their PaK guns around. Furthermore, the PaK 38 was too heavy for its crew to manhandle into position, which made it less tactically flexible than the 3.7cm PaK. (Ian Barter)

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A dramatic stack of KV-1 tanks forms the backdrop for German fighting positions, spring 1942. (Author)

absolute destruction of the heaviest tanks. The moral effect is immense. A thick black explosive effect envelops the whole tank and the blackened armor is burnt." In fact, only one of three *Stielgranaten* 41 fired penetrated the KV-1's turret and the other two rounds damaged the road wheels. Even under perfect range conditions and fired at a range of just 60m, the *Stielgranate* 41 proved not terribly accurate and required considerable operator skill. The tests concluded with 7.5cm IG 18 artillery firing HEAT ammunition against the KV-1 from 250m and a 10.5cm lFH 18 firing PzGr rot armor-piercing rounds from 750m, which inflicted moderate damage on the KV's track and road wheels. In direct fire, the 10.5cm gun crew achieved eight hits in 15 shots, indicating the limitations of artillery in the antitank role.

A true duel between Panzerjäger and KV-1 tanks occurred during February–May 1942 at the encircled town of Kholm. *Kampfgruppe Scherer*, which rarely had more than three or four PaK guns operational, was under constant Soviet tank attack for three months. During the siege, the Luftwaffe managed to fly in ten 5cm PaK and four 4.2cm PaK guns by glider, although seven of the 5cm PaK were subsequently lost in action. *Kampfgruppe Scherer* also received 109 *Stielgranate* 41 rounds for its 3.7cm PaK, but the results were disappointing: of 18 rounds fired, only nine hit the target and no enemy tanks were destroyed outright. Using PzGr 40 rounds, the 5cm PaK were able to disable KV-1 tanks on several occasions, but the Soviets were able to recover and repair them. Due to the inability of the Panzerjäger at Kholm to destroy Soviet heavy tanks, the garrison suffered constant losses from KV-1 tanks that would sit with near-impunity a few hundred meters from German-occupied buildings and pulverize them with high-explosive rounds.

Fight to the death at Demyansk. A KV-1 has run over a 5cm PaK 38 antitank gun but has itself been immobilized by damage to its right track. (Author)

As part of the effort to reorganize the Red Army's armored striking power, in February 1942 the Stavka began forming the first of 25 tank corps, which were each expected to have 169 tanks, including 24 KVs. With Chelyabinsk building over 250 new KV-1 tanks per month, a good number of these new tank corps would be ready for the spring battles. Unfortunately, the Stavka reduced the potential impact of the KV-1 on the battlefield by dispersing the limited numbers available across too many fronts and too many units. In early May 1942, for example, 28 were sent to the Bryansk Front, 20 to the Kalinin Front, 40 to the Southwest Front and 30 to the Crimea. Furthermore, the KV-1 Model 1942 tanks were significantly slower than the T-34s and T-70s in the tank corps, which made it impossible for them to keep up in fast-moving operations. A number of Soviet tank officers, such as Katukov, were dissatisfied with the KV's

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mobility and preferred that it be relegated to separate infantry-support battalions. Eventually, the Stavka authorized the creation of several heavy tank brigades, each equipped with between 24 and 40 KV-1 tanks.

The 7.5cm PaK 40 began to reach units on the Eastern Front in February 1942, but only 130 were delivered over the next three months. It was not until late 1942 that the PaK 40 was available in sufficient numbers to provide the Panzerjäger with a reliable means of defeating Soviet heavy tanks. (Ian Barter)

The German Panzerjäger units were also undergoing significant upgrades during spring 1942. A trickle of 7.5cm PaK guns began arriving in February–March and by May 1, 1942, there were 130 7.5cm PaK 40, 12 PaK 41, a few PaK 97/38 and several hundred PaK 36(r) guns on the Eastern Front. Six army-level Panzerjäger battalions began converting to self-propelled *Marder* IIs, while increased production of 5cm PaK 38s allowed a reorganization of the standard Panzerjäger company into two platoons of 3.7cm PaK and two platoons of 5cm PaK. However, losses of PaK guns had been so heavy in 1941 that many infantry divisions had few if any 5cm PaK left, and the OKH was forced to accept that the 3.7cm PaK would remain in service for some time. HEAT and tungsten-core PzGr 40 ammunition also began to appear in quantity, and the *Stielgranate* 41 provided the remaining 3.7cm guns with a last-ditch capability to engage KV-1 and T-34 tanks. However, the PaK 36(r) proved to be the best short-term answer to the KV-1; this was ironic, given that this weapon was based on an earlier Rheinmetall-Borsig design dating back to 1930. A good example of the depleted condition of German Panzerjäger units was the 256.Infanterie-Division in the 9 Armee, which on March 8, 1942 had only 20 3.7cm PaK and one 7.62cm PaK 36(r), with no operational 5cm PaK.

By January 1942 Chelyabinsk was completing over 200 KV-1 tanks per month and both Stalin and the Stavka were eager to get new heavy tank battalions to the front to lead powerful breakthrough attacks. Some 40 new KV-1 tanks were sent to join the 51st Army in the Crimea in late February, with the objective of breaking through the German 46.Infanterie-Division's defenses at Parpach. The German division defending the narrow neck of the Kerch Peninsula was particularly weak in antitank defenses, with no 5cm PaK 38 remaining. However, the Germans had a wide antitank ditch, backed up by minefields. When the Soviets attacked on February 27, the KV-1 company in the 56th Tank Brigade was able to get across the antitank ditch near Ak Monay and advance several kilometers into the German defenses, but became separated from their infantry support. A lone 10.5cm lFH 18 howitzer deployed in the antitank role began pounding the slow-moving KVs with the improved PzGr rot armor-piercing rounds, causing damage.

KV-1 tanks abandoned in the Crimea, May 1942. Efforts to break through the German defenses at the Parpach Narrows were frustrated by antitank ditches and minefields, rather than PaK fire. (Ian Barter)

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German 3.7cm PaK guns cleverly hidden behind the hulks of two knocked-out KV-1 tanks, summer 1942. The Panzerjäger were only able to hold back the KV-1 companies at the battle of Kharkov in May 1942 by adopting unconventional ambush tactics. (Ian Barter)

Then, Panzerknacker teams from the division pioneer battalion spearheaded a counterattack that managed to destroy two KV-1 tanks with demolition charges. By the end of the first day, most of the KV tanks were out of action and the Soviet offensive began to falter.

Disappointed by the failure in the Crimea, the Stavka intended to conduct a major counteroffensive with the Southwest Front at Kharkov in mid-May 1942. When the offensive began on May 12, the 21st and 28th Armies were supported by about 25 KV-1 tanks from the 10th Heavy Tank Brigade and several other tank brigades. The 10th Tank Brigade succeeded in smashing through the right flank of the German 79.Infanterie-Division and advanced 18km (11mi) on May 13–14. Panzerjäger-Abteilung 179 was virtually helpless against large numbers of KVs, since it had only 16 3.7cm PaK and four 5cm PaK guns at the start of the Soviet offensive. Instead, the 6.Armee was forced to rely upon minefields, 8.8cm Flak guns, heavy artillery and Stuka attacks to slow down the Soviet armored wedges. Infantrymen from the 79. Infanterie-Division were able to disable two KV-1 tanks by getting close enough to wedge T-mines under their turret overhang, and 3.7cm PaK gunners employed the *Stielgranate* 41 with some success. Eventually, the offensive by the 21st and 28th Armies began to run out of steam. After more than a week of heavy fighting, the two Soviet armies were forced onto the defensive and eventually defeated by German counterattacks. Losses of KV tanks approached 80 percent. However on the tactical level, the battle of Kharkov showed that the German Panzerjäger could not stop KV tanks on their own.

KV-1 ENGAGEMENT SEQUENCE

The KV-1 commander and gunner were hampered by the restricted view from inside the tank for most of the war, which made it almost impossible to detect and engage small, camouflaged enemy PaK guns first. Most KV-1 engagement sequences began in response to their own hull or turret being struck ineffectually by enemy shells, then trying to find the PaK gun with the PT-4-7 panoramic sight. However, as the German PaK guns grew larger in size and required larger prime movers to pull them, detecting them became less difficult for the KV-1 gunners.

Here, the commander of a KV-1 lying hull-down outside a village has spotted movement through his PT-4-7 panoramic sight (left) – a German half-track has brought a 7.5cm PaK 40 to an emplacement 600m distant on the edge of town. As the Germans finish setting up the PaK 40, the KV-1 commander informs his gunner, who lays on the target with his TMFD-7 sight (right). The loader sets the range fuse on the OF-350 HE-FRAG round to 600m and slams it into the breech. The gunner arms the main gun and when the commander says "Fire!" the gunner fires the ZIS-5 with his foot pedal. When the round impacts behind the target, the commander tells the gunner to drop 5 degrees and reengage. Even with an average crew, the KV-1 can fire off five rounds in a minute, which is sufficient to suppress and then damage the PaK 40 before it can reply.

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SUMMER 1942 BATTLES

After the Soviet defeat at Kharkov, *Heeresgruppe Süd* moved into high gear in late June with Operation *Blue*, boldly advancing toward Voronezh, Stalingrad and the Caucasus. Units like the 79.Infanterie-Division in the 6.Armee had a high priority for new antitank weapons and received eight 7.5cm PaK 40 and 12 7.62cm PaK 36(r). On July 4, Stalin ordered the newly formed 5th Tank Army to counterattack Panzergruppe 4 in the Don Bend, west of Voronezh. The 5th Tank Army had 641 tanks of which 83 were KV-1 tanks, but its tank brigades were committed piecemeal against the flank of the German XXIV Panzerkorps. Despite the fact that the two German Panzer divisions in the path of the Soviet armored phalanx were still armed with 5cm PaK 38s, no *Marder*s and only 32 PzKpfw IVF2 tanks with long 7.5cm guns, the Germans won a lopsided five-day tank melee. Even in good weather and on flat terrain, the KVs failed to make any impression on the German defensive positions and suffered over 90 percent losses in the battle. The KVs were defeated by a second-rate German antitank defense and Voronezh quickly fell despite the counterstroke. Stalin was so disappointed with the performance of the KV-1 in the May battles that he stated on June 5 that: "this tank is not needed. Its weight should be reduced and if this is not possible – retire it." Chelyabinsk was ordered to design a lighter version of the KV-1 quickly, in order to improve mobility and to correct some of the more egregious design flaws.

Kotin's team in Chelyabinsk, led by Nikolay Shashmurin, redesigned the KV-1 by shaving off 5 tons, which required thinning out the turret armor to only 80mm. Efforts were also made to upgrade the inadequate transmission and the air-cooling system in order to improve mobility. Although the 76.2mm ZIS-5 gun remained the same, an improved commander's cupola was added to enhance visibility. The new tank was dubbed the KV-1S ("speedy"), and its off-road speed was 8km/h (5mph) faster than earlier KV-1 models. However, KV-1S production would not begin until August and it would be fall before it would appear on the battlefield.

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A KV-1 destroyed near Voronezh, July 1942. The KV-1 heavy tanks were too slow to keep up with T-34 medium tanks in the new tank corps and often ended up operating without much infantry or artillery support, which made them vulnerable to antitank ambushes. (Bundesarchiv, Bild 101I-216-0412-07, Foto: Klintzsch)

In July, the Stavka began preparing for a series of offensives on other parts of the Eastern Front in order to draw German reserves away from Stalingrad. Despite his growing disillusionment with the KV, Stalin himself ensured that these Soviet operations would receive adequate numbers of KV-1 tanks to create breakthroughs. The first such Red Army offensive occurred on the Bryansk Front, where over 100 KV-1 tanks were massed to support an attack against the German 2.Panzerarmee north of Orel. However, after two weeks of combat near Zhizdra, the KV-1 tanks failed to break through the German antitank defenses. One Soviet unit, the 4th Guards Tank Brigade, lost all 24 of its KV-1 tanks in the offensive.

In an effort to stop the Germans short of Stalingrad, the Soviet 1st Tank Army launched a counterattack into the flank of the 6.Armee northwest of Kalach on July 27. Leytenant Vasiliy Krysov commanded a KV-1 in a set-piece attack by the 158th Heavy Tank Brigade against the village of Lozhki, held by part of the 60.Infanterie-Division (mot.). He recounted that: "A series of green flares soared into the sky! Our engine roared and our KV moved out towards the enemy… There was still about a kilometer and a half until we reached the enemy positions, it was beginning to grow lighter, and we could now make out the outlines of trees and the buildings of the collective farm. The Germans hadn't opened fire yet either, apparently conserving ammunition."

Once Krysov's brigade approached to within less than a kilometer of the village, "[they] opened a storm of fire. The German fire was extremely accurate! Almost immediately a shell glanced off our left side; our 47-ton vehicle rocked and the flame of the explosion illuminated the fighting compartment. I saw the flash of the gunshot but failed to spot the well-camouflaged gun…"

Krysov's platoon leader's KV was immobilized by an antitank mine but the rest of the KVs continued to close the distance. "Shell strikes continued glancing off the right and left sides, doing no serious damage to the hull – the machine kept rushing toward the enemy guns! All our tanks fired their main guns and machine guns on the move and during short halts… The Germans managed to hit us three times before we reached the enemy trenches, but the shells hadn't penetrated the armor." Reaching the edge of the village, Krysov spotted a PaK gun concealed behind a shack and ordered his driver to accelerate and crush it. He recounted, "less than a minute later, the tank

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A 5cm PaK 38 camouflaged in an urban environment. The Germans had not anticipated much antitank combat in cities but this became the norm in places such as Voronezh and Stalingrad in 1942. (Ian Barter)

heavily rocked and we could hear the loud sound of grinding metal from beneath the tank."[8]

In August, the Western Front attacked the eastern side of the Rzhev salient with two tank corps, equipped with over 300 tanks including 48 KV-1 tanks. However, the 9.Armee had received over two dozen of the superb 7.5cm PaK 41 weapons prior to the Soviet offensive and these much-improved PaK guns knocked out nearly half the Soviet tanks in a three-day battle around Zubtsov. Panzerjäger-Abteilung 561, equipped with 12 7.5cm PaK 41s, virtually brought two Soviet tank corps to a halt after minimal gains. Soviet KV tankers were stunned that PaK 41 gunners could penetrate their thick frontal armor at distances in excess of 1,000m. By the end of the battle, the Soviets had failed to achieve a breakthrough and had lost 41 of 48 KV-1 tanks. On August 10, the Soviet Northwest Front launched a major offensive against the narrow Ramushevo Corridor connecting the Demyansk salient to the 16.Armee. One KV-1 under Senior Leytenant Ivan Parshkova of the 33rd Tank Brigade managed to penetrate the tough German defenses near Rykalovo but was then immobilized. Parshkova's KV fought a six-day battle with local German troops and managed to knock out four PaK guns before he was forced to abandon the tank. However, this Soviet offensive failed as well, with the majority of KVs immobilized in the German minefields and then shot to pieces by concealed PaK guns. Soviet commanders were beginning to note that something had changed on the battlefield, with the German antitank defenses increasingly able to knock out KV-1 tanks at longer ranges and before the Soviet heavy tanks could even find the hidden PaK guns.

Between August and November 1942, five German infantry divisions – all in *Heeresgruppe Mitte* – each received a company of *Marder*s for their Panzerjäger battalions. Sufficient 7.5cm and 7.62cm PaK guns were available to provide most

8 Vasiliy Krysov, *Panzer Destroyer: Memoirs of a Red Army Tank Commander*, Pen & Sword, Barnsley (2010), pp. 8–11

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The KV-1S was introduced in August 1942 in an effort to rectify the mobility problems associated with previous models. Unfortunately, the "improved" KV-1S had less armor than its predecessors, which only made it more vulnerable to the new German antitank weapons. (Author)

German divisions with at least 8–10 heavy guns, and HEAT ammunition was more available. However, the number of tungsten-core rounds fell sharply after June 1942.

Based upon the tanks' lackluster performance in the summer battles, the Stavka decided in October to pull the remaining KVs out of the tank corps and place them in 14 separate guards tank regiments, each with 21 KV-1 tanks. From this point, the KV-1's tactical mission shifted from breakthrough tank to infantry-support tank. In December 1942, the new lighter KV-1S tanks finally began arriving in quantity and seven regiments of them were sent to the Don Front to participate in Operation *Koltso* – the reduction of the trapped German 6.Armee in the Stalingrad pocket. On January 10, 1943, the Soviet 21st and 65th Armies attacked the Marinovka salient on the west side of the pocket with over 100 KV tanks. Everything seemed in favor of the KV-1S tanks scoring a real success, since the terrain was relatively hard and flat. Furthermore, the three tattered German infantry divisions in their path were desperately short of

PAK 38 ENGAGEMENT SEQUENCE

The appearance of the KV-1 forced the Panzerjäger to adopt close-range ambush tactics, rather than the standard method of engaging enemy armor at 400–500m. Furthermore, even with the PzGr 40 tungsten-core round, the 5cm PaK 38's best chance of survival was to engage the KV-1 from the side or rear.

Here, a KV-1 advancing under low-light conditions at dusk has passed by a camouflaged 5cm PaK 38 position. When a flare from local German infantry goes up, the PaK 38 crew engages the KV-1 from a range of about 100m (left). At this range, the target practically fills the gunner's ZF 3 x 8 sight. The gunner places his aiming point on the KV-1's left final drive wheel. The Panzerjäger fire as fast as they can, hitting the KV-1 five times in rapid succession, which immobilizes but does not destroy the target. The engagement now becomes a frantic duel as the KV-1 brings its turret around to respond to its tormentor, while the PaK 38 crew rushes to finish off the wounded enemy before they are detected (right). At this range, neither side can miss.

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With their fuel and ammunition exhausted, the *Marder* II companies were unable to assist in the final defense of the Stalingrad pocket. Instead, many like these were captured nearly intact when the 6.Armee surrendered. (Author)

fuel and ammunition. Yet incredibly, the German defenses knocked our more than half the Soviet armor. The 44.Infanterie-Division's Panzerjäger-Abteilung 46 made a desperate last stand, based around a platoon of three 7.62cm PaK 36(r) guns, which inflicted heavy losses on the advancing Soviet tanks. Eventually, the German defense collapsed after three days and the survivors were forced to abandon their PaK guns as they retreated back across the steppe toward Stalingrad. Inside Stalingrad, all of the German *Marder* self-propelled guns were immobilized by lack of fuel and many were captured intact. By the end of the battle, the 6.Armee was crushed; but the KV-1S model had had an unspectacular combat debut, with over 80 percent lost to enemy action or mechanical failures within three weeks. Nevertheless, the German Panzerjäger could take no comfort from the problems experienced by the KV-1S tanks since their own losses at Stalingrad were catastrophic; three of the *Marder* II-equipped army-level battalions and 21 division-level Panzerjäger battalions were completely destroyed.

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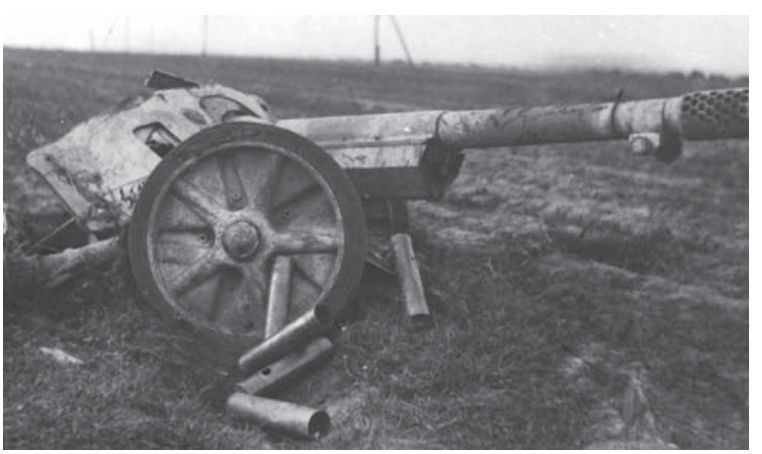
THE TIPPING POINT, 1943

The reequipping of the *Ostheer*'s Panzerjäger battalions continued unevenly throughout the winter of 1942/43, with large numbers of 3.7cm and 5cm weapons continuing to form the bulk of antitank weaponry well into 1943. For example, in the relatively well-equipped XXVII Armeekorps in the 9.Armee in the Rzhev salient in January 1943, only 29 percent of the 255 available PaK guns were 7.5cm or 7.62cm weapons, the majority of which were the sub-standard PaK 97/38. Even by the time of the battle of Kursk in July 1943, most infantry divisions had just 5–8 high-velocity heavy PaK guns, but retained 12 5cm and 40 3.7cm PaK guns. As Panzerjäger units received the new PaK weapons, the 7.5cm and 7.62cm guns were deployed as heavy platoons within companies that retained both 3.7cm and 5cm PaK guns.

Meanwhile, the Red Army was reconsidering the viability of the KV-1 after the tank's generally poor performance in 1942. While the need for a heavy breakthrough tank was now questioned by senior tank commanders, there was clearly a need for self-propelled heavy artillery to support the Red Army's offensive strategy. Noting the German success in mounting large-caliber guns on surplus tank chassis, Kotin proposed the KV-14, which consisted of a 152mm ML-20 howitzer mounted on a KV hull. The vehicle was ready for production in February 1943 and entered service as the SU-152. Once Chelyabinsk began diverting KV hulls to the SU-152 line, production of the KV-1S model dropped off to fewer than 100 units per month.

During the post-Stalingrad period of early 1943, the remaining KV-1 tanks were not used in the rapidly moving advance toward Kharkov and Rostov. Instead, the independent guards tank regiments were rebuilt and husbanded in the Stavka reserve. When the German offensive against the Kursk salient began on July 5, 1943, it was Koshkin's T-34 that was the dominant Soviet tank on the battlefield. It was not until the German offensive had exhausted itself and the Red Army prepared for a counterblow against the 9.Armee in the Orel salient that the KV-1S regiments were committed. The Bryansk Front massed over 300 tanks, including 80 KV-1 tanks, against the eastern face of the Orel salient, which was held by the German XXXV Armeekorps. The four infantry divisions in the corps had only 31 heavy PaK guns – 15 PaK 40, seven PaK 41 and nine PaK 36(r) – to defend a 140km (87mi) front, although the 9.Armee had three companies of tank destroyers in local reserve, including ten of the new *Hornisse* (Hornet) 8.8cm self-propelled guns. After a two-hour artillery preparation on the morning of July 12, the Bryansk Front committed six rifle divisions supported by three KV-1 regiments at the junction of the German 56. and 262.Infanterie-Divisionen. The Soviet attack succeeded in penetrating several kilometers into the German defenses and even overran some German



A destroyed 7.5cm PaK 97/38. This weapon was introduced because the Germans needed a low-velocity gun that could fire their hollow-charge ammunition, and so the venerable French 75mm cannon was pressed into service as an interim solution. (Courtesy of the Central Museum of the Armed Forces, Moscow via Stavka, K 176)

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artillery, but the slowness of the KV-1 wedges gave the 9.Armee sufficient time to reinforce XXXV Armeekorps with 30 self-propelled heavy PaK. Soviet tankers found it much harder going on July 13, with *Hornisse* and *Marder* platoons deployed to block their advance. Advancing into the German engagement areas, KV-1 crews suddenly found that their invulnerability was a thing of the past, as their armor was ripped asunder by high-velocity 7.5cm and 8.8cm PaK rounds. Even the 3.7cm PaK – long derided as useless – managed to destroy one of the attacking KV-1 tanks with a *Stielgranate* 41 round. After three days of trying to bash their way through the German antitank barrier, the KV regiments were virtually destroyed.

The battle of the Orel salient represented the end for the KV-1-series heavy tank, for it was now obvious that it could not undertake its breakthrough role and it was less versatile than the T-34. The last KV-1 tanks were built in August and then Chelyabinsk switched entirely to production of the SU-152. By July 1943, the remaining KV-1 tanks were simply large, slow targets that could be readily dispatched at distances up to 1,500m by the growing number of German heavy PaK guns. The appearance of the *Hornisse* 8.8cm self-propelled gun indicated that the days of the Panzerjäger having to rely entirely upon underpowered armament and near-suicidal tactics were drawing to a close, and that Soviet heavy tanks would no longer operate with near impunity – if they could be seen, they could be killed.

The KV's swan song – German XXXV Armeekorps' antitank defense slaughters KV-led attack on the Orel salient, July 13, 1943 (overleaf)

After the culmination of the German *Heeresgruppe Mitte*'s offensive against the northern side of the Kursk salient in July 1943, the Stavka ordered three Soviet fronts to launch concentric attacks against the Orel salient. Since the German infantry divisions defending the salient had over a year to prepare their defenses, the Red Army expected to conduct powerful breakthrough attacks to punch through the German defensive lines in several places, then roll them up. The Bryansk Front massed six rifle divisions and about 300 tanks against the German XXXV Armeekorps defending the eastern side of the salient, near Novosil. Three separate regiments of KV-1 tanks would spearhead the assault, concentrating against the boundary between the 56. and 262.Infanterie-Divisionen. Awaiting them, the 262.Infanterie-Division had 61 antitank guns, including four PaK 36(r), three PaK 41 and one PaK 40.

On the morning of July 12, the 3rd Army fired a heavy artillery preparation and then attacked with its infantry, who managed to claw their way into the German first line of defense. Encouraged by this success, the Soviets committed 200 tanks, hoping to crush the last German resistance and create a decisive breakthrough. Initially, the Soviet heavy tanks were able to eliminate five 5cm PaK and then overrun some artillery units, but the Germans quickly redeployed Panzerjäger-Kompanie 521 with nine *Hornisse* 8.8cm self-propelled guns to Arkhangel'skoye. When the 114th Separate Tank Regiment renewed its attack across the open terrain east of the town on the morning of July 13, the KV-1 tanks came under intense and accurate PaK fire from several sides. A German 7.5cm PaK 41 deployed in the woods south of the town proceeded methodically to pick off the slow-moving KV-1 tanks, piercing their hulls with high-velocity 7.5cm PzGr 41 Hartkern (hard-core) rounds. Nevertheless, the brave KV tankers pressed on through the kill zone and managed to close in on German 5cm PaK positions on the edge of town. However, the Germans had learned about KV overrun tactics and surrounded their PaK guns with barbed-wire obstacles and Teller mines; when two KV-1 tanks attempted to crush PaK guns, they had their tracks blown off. The Soviet heavy tank regiment was massacred by the heavy German PaK guns and the attack in this sector was defeated.

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STATISTICS AND ANALYSIS

The German Panzerjäger were completely surprised by the KV-1 in June 1941 and were forced to participate in a one-sided duel with it for the next year. The technological assumptions that the Wehrmacht had made about antitank warfare – that the 3.7cm and 5cm PaK would suffice for the time being – proved to be disastrously wrong. Indeed, the German antitank debacle was one of the greatest technological surprises of World War II; far more serious than Allied tank problems dealing with the German Tiger and Panther tanks in 1944. Between June 1941 and May 1942, over 3,600 3.7cm PaK 36 and 350 5cm PaK 38 guns were lost, many crushed under the tracks of

A 5cm PaK 38 run over by a T-34 tank. The German Panzerjäger suffered appalling losses in 1941–42 due to Soviet tank attacks, which often ended with the ineffectual guns being crushed under the tanks' tracks. (Author)

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the dreaded KV-1 tank. Indeed, 45 percent of the 3.7cm PaKs initially committed to Operation *Barbarossa* were lost – a staggering degree of attrition. Losses among Panzerjäger crews were equally heavy.

In comparison, about 900 of the 1,540 KV-1/KV-2s available to the Red Army in the first six months of the invasion were lost, according to Soviet statistics. Based on partial information available from battle reports, it appears that only about 24 percent of these KVs were lost in combat; but 61 percent were abandoned or destroyed by their crews – usually because of mechanical defects or lack of fuel. Early models of the KV also suffered from an appallingly low operational readiness rate – much lower than the T-34. At no point after the first week of the invasion was the Red Army able to mass more than 20–30 KVs in one sector and often only in platoon- or company-size packets. Of the approximately 215 KVs lost in combat in 1941, probably half were knocked out or immobilized by 8.8cm Flak guns or heavy artillery, with the rest falling victim either to antitank mines and point-blank PaK or tank fire. As a general rule, KVs knocked out 3–4 PaK guns before they themselves were knocked out, which suggests that the duel in 1941 saw the loss of about 100 KVs in exchange for 300–400 PaK guns.

A 5cm PaK 38 in the streets of Stalingrad. While in its death throes, the trapped 6.Armee managed to knock out a surprising number of KV-1 tanks in the final month of fighting. (Ian Barter)

Whatever the actual numbers, it is clear that the KV heavy tank overwhelmingly won the duel in 1941, even though logistic problems, lack of training and a variety of other deficiencies prevented the Red Army from capitalizing on the KV's tactical supremacy. On the other hand, the inability of the German Panzerjäger to overcome the significant numbers of KVs around Leningrad prevented *Heeresgruppe Nord* from capturing that objective.

In 1942, the duel between Panzerjäger and KVs became something of a race to see whether the Germans could deploy sufficient numbers of heavy PaK guns before large numbers of improved KVs appeared on the battlefield. The Germans won this race by the slimmest of margins, mostly by restocking their Panzerjäger companies with captured French and Soviet weapons and arming them with HEAT ammunition. About 1,200 KVs were lost in 1942 – half of all those built that year. However, far fewer KVs were lost to mechanical defects or fuel shortages in 1942 and the German Panzerjäger destroyed a much larger percentage of them. By late 1942, KVs had lost their battlefield immunity and the balance began to shift in favor of the Panzerjäger.

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Soviet infantry advance behind a KV-1S during the summer of 1943. Although the "speedy" model offered better mobility than previous models, it did so at the expense of armor plate and was introduced just as the Germans were fielding their own upgraded Panzerjäger weapons. The net result was to push the KV-1 over the brink from useful heavy infantry-support tank to large, vulnerable, slow-moving target, which hastened its removal from the battlefield. (Courtesy of the Central Museum of the Armed Forces, Moscow via Stavka)

In 1943, the duel was decided in favor of the Panzerjäger once most German divisions received at least a company of 7.5cm or 7.62cm PaK guns. Despite improvements, the KV-1S was still a large, slow target and by mid-1943 the Germans had gained a clear ascendency over the KV, which forced the Red Army to withdraw it from service. Thanks to the Panzerjäger vs KV-1 duel, German antitank capabilities became much greater from 1943 until the end of the war, which would take an enormous toll of Allied and Soviet tankers in 1944–45.

The failure of the KV heavy tank to translate its superior technical characteristics into a decisive advantage is illustrative of the nature of weapons that rely too heavily on one factor. For the Germans, defeating the KV became merely a matter of deploying a weapon with sufficient penetrative power to cancel out the KV's armor protection. For the Soviets, the KV's weakness in mobility tended to reduce the value of its armor – lacking the T-34's maneuverability, the KV often was little more than a mobile bunker.

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AFTERMATH

The KV-1 was a giant with feet of clay. Kotin's mismanagement of the heavy tank program in Leningrad in 1937–39 wasted too many resources on creating alternate designs, rather than focusing on perfecting a single design. Compared to Koshkin's management of the T-34 medium tank program, Kotin's effort resulted in a heavy tank that fell far short of the Red Army's expectations. Instead of building the best heavy tank his team could design, Kotin simply piled ore armor plate onto an already overloaded chassis but failed to ensure that it had sufficient motive power to accomplish its mission.

Despite the demise of the KV-1, Kotin proceeded with development of a new heavy tank, which eventually emerged as the IS-2 in December 1943. While the IS-2 was a significant improvement over the KV-1 in terms of firepower, mobility and protection, the Red Army leadership decided to leave them in the separate guards tank regiments and use them primarily in the infantry-support role. German late-war PaKs and *Panzerfaust*-armed infantry would prove a formidable opponent even for the IS-2s, and thus eavy tanks never regained the battlefield dominance that the KV-1 had enjoyed in the winter of 1941/42.

In an odd footnote to the Soviet heavy tank program, the engineer who designed the KV-1, Nikolay L. Dukhov, transferred to the KB-11 design team in 1948 and became the deputy chief designer of the first Soviet atomic bomb. Later, Dukhov worked on the first Soviet hydrogen bomb as well. Although almost unknown in the West, Dukhov's engineering talent was clearly of great value to the Red Army, stretching from the KV-1 to the hydrogen bomb.

On the other side of the hill, the German Panzerjäger experience of being outgunned by the KV-1 for nearly two years speaks volumes about the Third Reich's lack of preparedness for total war. The fact that German industry lacked the resources

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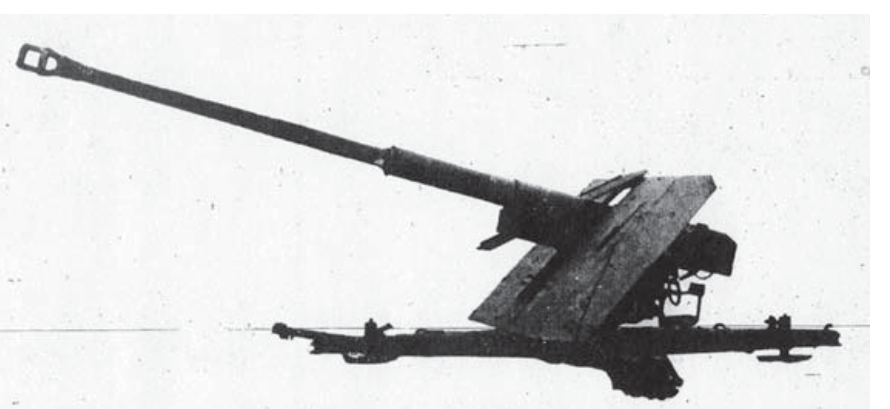
The *Hornisse* tank destroyer, equipped with the 8.8cm gun, began to reach the Eastern Front in spring 1943. The *Hornisse* could destroy a KV-1 at 2,000m, as demonstrated during the defense of the Orel salient. (Bundesarchiv, Bild 101I-279-0950-09, Foto: Bergmann, Johannes)

to replace the 3.7cm PaK with better 5cm and 7.5cm weapons also is a telling weakness. While Allied tankers would later complain about the "Tiger scare" on the Western Front for a few months in the summer of 1944, they still had potent 17-pdr antitank guns available to deal with the occasional German heavy tank. Unlike the Panzerjäger experience on the Eastern Front in 1941–43, Allied troops were not regularly forced to fight enemy heavy tanks with flaming petrol bombs and hand-delivered antitank mines.

After mid-1943, German Panzerjäger capabilities evolved rapidly. The *Panzerfaust* 30 was introduced in August, followed by the *Panzerschreck* in October, both of which used HEAT warheads to provide the infantry with an inexpensive but reliable antitank capability. Once the infantry began to receive HEAT-equipped weapons, the need for PaK guns at regimental level declined and Panzerjäger units focused on wielding heavy PaK guns to defend increasingly wide divisional sectors. In addition to the *Hornisse*, the towed 8.8cm PaK 43 began to reach the front in November 1943, providing the Panzerjäger with a weapon that could defeat all Soviet heavy tanks, even the KV-1's successor, the IS-2. As 1943 ended, German antitank capabilities at division level had increased by an order of magnitude over those of 1941, even though the war was as good as lost.



The towed 8.8cm PaK 43 arrived on the Eastern Front in fall 1943. Although a potent answer to the KV-1, the PaK 43 was a repudiation of previous German Panzerjäger doctrine since it had little mobility and was difficult to conceal. When the German Army retreated – as it was always doing after Kursk – heavy weapons like this were likely to be abandoned. (Author)

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Dedication

In remembrance of CPT John P. Gaffaney and the 11 other soldiers killed in action by a terrorist attack at Fort Hood, Texas on November 5, 2009.

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All measurements in this book are given in metric. For ease of comparison, readers should refer to the following conversion chart:

1 mile = 1.6km
1yd = 0.9m
1ft = 0.3m
1in = 2.54cm/25.4mm
1 gallon (US) = 3.8 liters
1 ton (US) = 0.9 metric tons
1lb = 0.45kg

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Glossary

ABTU	*Avto-Brone-Tankovoe Upravlenie* (Automotive and Armored Vehicle Directorate)
AP	Armor Piercing
APC	Armor Piercing Capped
APCR	Armor Piercing Composite Rigid
APHE	Armor Piercing High Explosive
GKO	*Gosudarstvennyj komitet oborony* (State Defense Committee)
HEAT	High Explosive, Antitank
Heereswaffenamt	Army Weapons Department
HE-FRAG	High Explosive–Fragmentation
OKH	*Oberkommando des Heeres* (High Command of the Army)
OKMO	*Opytniy Konstruktorsko-Mekhanicheskiy Otdel* (Experimental Design Mechanical Department)
PaK	*PanzerAbwehrkanone* (Antitank cannon)
Truppenamt	Troop Office
UMM	*Upravlenie Motorizatzii i Mekhanizatzii* (Office of Mechanization and Motorization)

Comparative ranks

English	Russian	German
Major general	General-Major	Generalleutnant
Colonel	Polkovnik	Oberst
Lieutenant colonel	Podpolkovnik	Oberstleutnant
Major	Major	Major
Captain	Kapitan	Hauptmann
Senior lieutenant	Starshiy leytenant	Oberleutnant
Lieutenant	Leytenant	Leutnant
Junior lieutenant	Mladshiy leytenant	n/a
Sergeant (US)	Serzhant	Unteroffizier
Corporal	Yefreytor	Obergefreiter
Lance-corporal	Yefreytor	Gefreiter
Private	Krasnoarmeyets Soldat	Schütze

Key to military symbols